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Keynote Speakers

Human Kinetics Keynote Lecture

Time for Change: New Venues for Development and Innovation

Nilam Ram, Stanford University

The devices in our pockets and on our wrists often demand our immediate attention. They also facilitate full-scale reconsideration of how we study and optimize human behavior. Daily and digital life have merged. Data are everywhere – opening new opportunities to observe, probe, and modify every imaginable aspect of human behavior – at a scale we never imagined. Using collections of intensive longitudinal data from survey panels, experience sampling studies, social media, laboratory observations, and our new Screenomics paradigm, I illustrate how consideration of zooms, tensions, and switches (ZOOTS) is transforming our understanding of human movement. Along the way, I develop calls for more flexible definitions of time, fluidity and diversity of methodological approach, and engagement with science that adds good into the world.

Keynote Speaker: Motor Development

Using Cognitive Strategies to Facilitate Motor Skill Acquisition in Children With DCD

Jill G. Zwicker, University of British Columbia

Developmental Coordination Disorder (DCD) affects a child's ability to learn motor skills and perform daily activities. One of the internationally recommended interventions for DCD is the Cognitive Orientation to Occupational Performance (CO-OP) approach. We recently conducted a randomized waitlist-control trial to examine motor outcomes and brain changes before and after CO-OP intervention. This presentation will highlight key principles of this treatment approach and review findings related to motor skills, movement quality, and motor function. Neuroplastic changes in brain structure and function after CO-OP intervention will be described and implications for practice will be discussed.

Keynote Speaker: Motor Learning and Control

Movement as a Window to the Mind

Alaa Ahmed, University of Michigan

The two principal functions of the brain, making of decisions and making of movements, are typically studied in disparate domains. However, recent findings have revealed an intriguing connection between the two: we prefer the option with the greater value, and also move faster to acquire it. Thus, the neural systems that represent the value of an option and drive decision-making, also influence the neural systems that control movements. To better understand this, we have developed a mathematical framework demonstrating how critical decision-making variables such as reward and effort can influence not only the choice of what to do, but also the speed of the movement follows. I will present results demonstrating that expectation of reward increases speed of saccadic eye and reaching movements, whereas expectation of effort expenditure decreases this speed. Additionally, these immediate effects of reward and effort on vigor can be modulated by an individual's internal state, reflected by their recent history of action. These results and others imply that vigor may serve as a new, real-time metric with which to quantify subjective value, and that the control of movements may be an implicit reflection of the brain's economic evaluation of the expected outcome.

Keynote Speaker: Sport and Exercise Psychology

Promoting Cognitive Health and Mobility in Aging

Teresa Liu-Ambrose, University of British Columbia

As the world's aging population rapidly increases, efficient (i.e., effective and cost-effective/cost-saving) strategies to promote healthy aging at a population level becomes a necessary health care priority. Of particular revelance, the maintenance of mobility and cognitive function are of utmost importance as they are vital to healthy aging, functional independence, and quality of life. Current evidence established that mobility and cognitive impairments are associated and often co-exist among older adults. Physical exercise is an inexpensive treatment that could have substantial preventative and restorative properties for cognitive function and mobility. In this presentation, we will review the current evidence regarding the role of physical exercise in promoting cognitive and mobility outcomes in older adults. We will highlight potential underlying mechanisms and moderators. We conclude with future directions in this rapidly expanding and important field of research.

Senior Lectures

Motor Development

Motor Trajectories, Risk and Protective Factors, and Cognitive-Motor Intervention for Children Living in Vulnerability

Nadia Cristina Valentini, Universidade Federal do Rio Grande do Sul

A sequence of challenges and productive encounters with constructive people shape the direction of my research career. As a Physical Education teacher working in a Low-Middle Income Country (LMIC), I learned to teach with few resources and understood the relevance of ecological insertion in the community and parental cooperation for children to learn. As a master's and Ph.D. student, I had the opportunity to acquire theoretical knowledge and develop critical thinking and research skills. As a professor who chose to go back home and start a university career in an LMIC, I understood that my strength was combining the knowledge I had acquired in public schools in Brazil with the ones from American universities. Therefore, my career has been an effort to produce quality research and, at the same time to provide community service for the children living in vulnerability. This presentation will share my beliefs, work, results, and what I have learned over 20 years as a university professor. I will show how the adversities I encountered were an opportunity to be creative and advance my line of research. I will discuss the relevance of enduring national data gathering to validate instruments from other cultures to assess Brazilian children, the vital role of understanding children's motor trajectories to detect delays, risk and protective factors, and the need to provide intervention in critical periods. I will conclude this talk with the importance of further understanding the context of development to design interventions that improve cognitive, social, and motor outcomes for vulnerable children.

Motor Learning and Control

Following My Curiosity and Exploring the Motor Behavior Landscape

Romeo Chua, University of British Columbia

My introduction to the area of human motor behavior began over 30 years ago through an undergraduate course led by one of my first mentors, Dr. David Goodman. Exploring the many facets of motor control and learning with the guidance of Dr. Goodman and Dr. Richard Schmidt's Motor Control and Learning text (1988), I became fascinated with human motor control and its blend of kinesiology, biomechanics, psychology, neuroscience and more. Responding to an invitation for research assistants by Dr. Goodman led to my first exposure to a research lab and the research process. There, I met another of my lifelong mentors, Dr. Digby Elliott. To make a long story short, I've never really left the lab since. My continuing academic journey through the human motor control landscape has been shaped by many mentors along the way, as well as many research collaborators and students whose experience and brilliance have benefitted my career. For better or worse, my research interests and work over the years have been somewhat scattered ... like my brain. Despite being once told that I'm "not known for anything", I've continued along the scattered paths. This has allowed me to investigate several lines of research, fueled my curiosity about the human sensorimotor system, and to learn from many scholars along the way. From manual asymmetries in the preparation of aiming movements (Asilomar 1991) to explicit process in sensorimotor adaptation (online 2020), the neurobehavioral mechanisms underlying the preparation, execution, and adaptation of perceptual-motor actions have remained a lifelong source of scientific curiosity.

Sport and Exercise Psychology

A Career in Physical Activity and Mental Health: Research at the Edge of Chaos

Catherine M. Sabiston, University of British Columbia

My career in sport and exercise psychology can be summed up as chaotic: a nonlinear dynamical system navigating simultaneous counteracting forces pushing for stability and order (e.g., theory, measurement, replication, study design, ethics) and instability and disorder (e.g., industry partnerships, impact, health services, clinical care – innovation and initiative). The balance of the forces has no doubt led to the publication, presentation, and funding outcomes that may be important for traditional metrics of impact in academics; but the chaotic state has been the most rewarding. In a state of chaos, there is a sensitive dependence on initial conditions – the butterfly effect. Since 2003, NASPSPA has had an unpredictably large impact on my career with many instances of the butterfly effect. Every keynote, presentation, and informal discussion around the poster boards have led to change. NASPSPA has been a place where I have: (i) presented my research evolving body-related self-conscious emotions from 'just' social physique anxiety to shame, guilt, pride, envy, and embarrassment; (ii) shared physical activity and mental health program materials so we can make a difference for more people; (iii) developed amazing collaborations with incredible people from around the World; (iv) innovated ideas for unique research; (v) met lifelong mentors and role models; (vi) introduced new measurement ideas, theories, and multidisciplinary work; and (vii) learned to mentor students and trainees to be accomplished researchers and practitioners (and a few life lessons along the way!). On this last note, my NASPSPA-infused career is also dissipative whereby the chaotic evolution is organized around strange attractors – the students and trainees in my lab (the only time I can call them 'strange'!). They are NASPSPA presenters, award winners, committee members, and leaders in sport and exercise psychology and keep some balance to the bifurcation process. They have learned to conduct research at the edge of chaos and to accept change, learn from mistakes, embrace uncertainty, and not to fear innovation and impact. These messages will serve as the basis of my senior (insert crying and laughing emojis here) lecture. Embrace the butterflies.

Early Career Distinguished Scholar Award

Spaghetti, Old Wine, and Roads Less Traveled: Reflections From a Youth Sport Scholar, Coach, Parent, and Athlete

Travis Dorsch, Utah State University

Passion for a life's work entails periods of discovery, development, and deepening. As a first-year graduate student, it was daunting sitting across the table from my mentor, Dr. Alan Smith. Nonetheless, we planted seeds that would ultimately grow into a fruitful research agenda. In this presentation, I will discuss my period of *discovery* by explicating my thesis and dissertation findings from Purdue University. This work highlighted the process of parent sport socialization – or the ways parents change as a result of their children's sport participation. I will also discuss my ongoing period of *development* by highlighting my trajectory of work as a faculty member at Utah State University, where my research interests have broadened to include the multiple persons and contexts that influence and are influenced by athletes' behaviors, attitudes, experiences, and outcomes. In conducting youth sport research, my most meaningful contributions have gone beyond knowledge creation to also deliver a public good ... to individuals, families, teams, organizations,

communities, and society. In my time as an early-career scholar, I am blessed to have collaborated with multiple colleagues, doctoral students, and undergraduate researchers, with whom I have generated empirical understanding of many aspects of the youth sport system. I am grateful to these collaborators, as through our efforts, I have learned much about myself, youth sport, and society at large. Although I began my academic journey with a narrow focus on children's ability to socialize their parents through sport, today I understand more clearly how athletes, parents, siblings, peers, and coaches influence one another. Moreover, I've come to appreciate how families, teams, organizations, communities, and societies shape and are shaped by these individuals' behaviors, attitudes, experiences, and outcomes. Guided by a systems lens, I look forward to a period of scholarly *deepening* over the coming decades. I'm excited about the many scholarly adventures that await, and hope I can connect with many of you along the way!

The NASPSPA Outstanding Student Paper Award Recipients

Motor Development

Examining the Usability, Acceptability, and Feasibility of an Online Platform for Parents to Support Preschoolers' Physical Literacy Development

Maeghan E. James, University of Toronto; Nikoleta Odorico, University of Toronto; John Cairney, University of Queensland; Kelly P. Arbour-Nicitopoulos, University of Toronto

Physical literacy (PL) involves motor, affective, social, and cognitive capabilities that begin to develop in early childhood and together influence physical activity (PA) and health. Parents play an important role in early child development, and thus PL interventions that engage parents may also serve as an opportunity to enhance a child's early PL development. However, few PL interventions include parents and those that do report low parental engagement outside of the intervention. This study aimed to develop and evaluate the usability, acceptability, and feasibility of an online learning platform for parents to support preschoolers' PL at home. The online platform was based on an existing, in-person, and instructor-led PL intervention for preschoolers, and was evaluated using a mixed methods research design. Twenty parents ($M_{age} = 35.7$, SD = 4.2) of children aged 3-4 years ($M_{age} = 4.1$, SD = 0.6) were randomly assigned to 3 out of 10 weekly modules. Parents completed a weekly usage and feedback questionnaire (1=strongly disagree, 5=strongly agree). Additionally, 14 parents were interviewed upon completion of the modules. Data were analyzed using descriptive statistics (questionnaires) and inductive thematic analysis (interviews). On average, parents engaged in the online activities with their child 4 days/week. Parents indicated the online platform was usable (4.5/5), useful (4.5/5), feasible (4.4/5), enjoyable (4.5/5) and acceptable (4.5/5). The thematic analysis identified five themes underlying parents' usage and implementation of the online platform and associated activities at home: *activity organization and planning*, *(de)motivators*, *parent knowledge and skills*, *experience with the platform* and *application to everyday routines*. Findings show that web-based approaches for engaging parents of preschoolers in PL interventions are generally acceptable and feasible. However, factors such as time and knowledge may impact parental engagement at home. Future research is needed to understand the role of parent PL support in the early years. Funding: University of Toronto. Funding source: University of Toronto Student Engagement Award.

A 10-Week Adapted Zumba® Program Improves Functional Mobility and Aerobic Capacity in Adults With Developmental Disabilities

Emily Munn, Auburn University; Danielle Lang, Auburn University; Janette Hynes, Auburn University; Alice Northcutt, Auburn University; Melissa Pangelinan, Auburn University

Adults with developmental disabilities exhibit deficits in aerobic capacity, functional mobility, balance, body composition, and executive functioning across development. Different exercise interventions have been shown to improve different outcomes measures in this population. However, few studies have examined the impact of adapted exercise interventions from a more comprehensive perspective (i.e., physical and cognitive health). The present study examined the effects of a 10-week (2 session/week, 1 hour/session) adapted Zumba® dance intervention on aerobic capacity, functional mobility, balance, body composition, and executive functioning in 44 adults with developmental disabilities ages 20.79 – 69.24. In addition to examining the overall differences between a control and intervention group, differences in tempo were examined. To this end, participants were quasi-randomized (to match the level of function across groups) into one of three groups: control (regular daily activities, $n = 44$), low tempo Zumba® (0.75 speed; $n = 23$), and high tempo Zumba® (normal speed; $n = 21$). We employed a cross-over design with a 3-month wash-out period. A significant Group x Time interaction was observed for the 6-Minute Walk Test ($F(2, 121) = 7.33$, $p < .001$) and Timed-Up-And-Go ($F(2, 122) = 5.61$, $p < .005$). Participants in the slow and fast tempo Zumba® groups significantly increased the distance walked for the 6-Minute Walk Test and reduced the total time for the Timed-Up-And-Go. The control group did not improve for either task. There were no significant Group x Time interactions for the Clinical Test of Sensory Interaction in Balance, Percent Body Fat, or Flanker Task. Taken together, these results suggest that 10-weeks of adapted Zumba® improves functional mobility and aerobic capacity, but not balance, body composition, and executive function in adults with developmental disabilities. Moreover, adapted Zumba® with a slower tempo may enable a broader range of adults with disabilities to participate and benefit from this type of program.

Motor Learning and Control

Canadian Physiotherapists' Perceived Barriers to External Focus Cue Use

Julia Hussien, University of Ottawa; Lauren Shearer, University of Ottawa; Lauren Gignac, University of Ottawa; Diane M. Ste-Marie, University of Ottawa

Research showing the benefits of adopting an external focus of attention (EFOA) has often emphasized its value for the field of rehabilitation. Observational studies, as well as our own self-report study, however, have shown a low provision of EFOA cues by physiotherapists. Thus, the purpose of this study was to explore barriers to EFOA cueing in physiotherapy that may account for this research-practice gap. To this end, eight Southern-Ontario physiotherapists ($M_{age} = 35.6 \pm 10.8$ years; $M_{experience} = 11.0 \pm 9.2$ years) participated in virtual one-on-one interviews. An interview guide was developed and physiotherapists were asked to report on their perceptions of common barriers to EFOA cueing in physiotherapy, as well as any potential solutions to the identified barriers. Using an evolving coding scheme, interview transcripts were coded independently by two researchers, with a third included for the rare occurrences in which consensus was not attained. Barriers reported by all participants included both a lack of awareness and knowledge surrounding the attentional focus literature, as well as content gaps in their physiotherapy education. As examples, physiotherapists perceived a lack of adequate course content on

motor learning principles within their curriculum and in post-graduate workshops. Additionally, physiotherapists reported on learning to use internal cueing more through implicit means, such as clinical placements, as opposed to explicit content. Discussions around solutions focused primarily on educating physiotherapists on the benefits of an EFOA. Physiotherapists suggested that motor learning principles in general, including attentional focus, should be integrated into their physiotherapy curriculums. Further, for a more immediate solution, they recommended the creation of a continued education course specific to attentional focus. The next steps in our research align with this recommendation as it involves the development, implementation and assessment of an educational workshop on the topic of attentional focus to local physiotherapists. Funding source: Ontario Graduate Scholarship.

Sport and Exercise Psychology

Assessing the Effects of a Physical Activity mHealth Intervention Among Individuals With Spinal Cord Injury: A Randomized Controlled Trial

Sarah Lawrason, University of British Columbia; Kathleen Martin Ginis, University of British Columbia

Theory-based interventions that use integrated knowledge translation (Graham et al., 2006) to promote quality physical activity (PA) participation are needed for individuals with spinal cord injury (SCI [Ma et al., 2020]). SCI Step Together, an mHealth program, was developed in partnership with Curatio Inc. and end-users to improve the quantity and quality of PA among persons with SCI (Lawrason et al., under review). Guided by self-determination theory (Ryan & Deci, 2000), the program allows individuals to participate in modules about PA (e.g., goal setting), connect with peers and a health coach, and track PA. The purpose of this study was to test the effects of the SCI Step Together program on the self-determination theory variables, PA, and quality of PA. An 8-week pilot randomized controlled trial was conducted among 21 participants ($n = 11$ intervention). Participants responded to questionnaires at baseline, mid-, and post-intervention. Results were analyzed using linear mixed effects models. The intervention group had greater fulfillment of basic psychological needs (interaction effect, $p = 0.05$) and knowledge (interaction effect, $p = .05$) compared to the control group. Both groups had decreased levels of social influences over time (time effect, $p = .01$), but the control group scored lower at 8-weeks than baseline ($p = .03$). Both groups increased self-monitoring over time (time effect, $p < .01$) but the intervention group did more self-monitoring at 4-weeks than at baseline ($p = .04$). There were no significant effects for any other outcomes (motivation, determinants of PA, action control, PA participation, quality of PA experiences). Despite no changes in the quantity or quality of PA, this study demonstrated that a mHealth program can improve individuals' basic psychological needs and knowledge to complete PA and may mitigate losses in social influences for PA over time. This intervention may inform future mHealth programs for persons with SCI. Funding source: Social Sciences and Humanities Research Council Doctoral Award.

Symposia

Motor Learning and Control Symposium

Individual Differences in Motor Learning and Performance

A Brief History of Research on Individual Differences in Motor Learning and Performance

David I. Anderson, San Francisco State University; A. Mark Williams, Florida Institute for Human and Machine Cognition & University of Utah

The purpose of this symposium is to draw attention to the range of research currently addressing the topic of individual differences in motor skill learning and performance. Our understanding of how individual differences influence skill acquisition and performance and how practitioners can capitalize on individual differences to enhance learning and performance is relatively poor. Consequently, enormous potential exists to develop a systematic program of research on individual differences that has theoretical and practical impact. The five talks in the symposium take varied approaches to studying individual differences. The first talk introduces the topic of individual differences in performance and learning by highlighting the major issues that have interested researchers during different historical periods and the key questions and controversies. The second talk examines an issue that has received almost no attention in the empirical literature: the "non-learner." The talk introduces a novel task researchers have used to identify what differentiates "learners" from "non-learners" and then describes how the task is being used to explore individual differences in a large cohort of individuals enrolled in an Alzheimer's disease study. The third talk explores how individual differences in participants' propensity to engage certain types of internal representations influences learning of a novel motor task and tendency to engage in movement specific reinvestment. The fourth talk describes recent studies on the effects of differences in individuals' achievement, affiliation, and power motives on novice's motor performance under pressure and elite athlete's performance during competition. The final talk offers novel insights into how researchers can enhance the study of expertise by combining group-based and individual-difference-based approaches to the study of performance and learning. We hope this symposium will contribute to individual differences becoming a more prominent feature of motor learning research and applied practice moving forward.

Hope for the Non-Learner and How Individual Motor Learning Capability Maps Onto Risk Factors for Dementia

Andrew Hooyman, Arizona State University

The observation of motor skill "non-learning" is a peculiar phenomenon that seemingly violates our assumptions about practice and learning. Although non-learners are considered rare, several researchers have demonstrated that a sub-group of non-learners can make up 25% of a single study cohort; however, the precise behavior of non-learners is relatively unknown. In a previously published study, we used a discovery task, which requires participants to learn a novel task rule to be successful and which has previously generated a large group of non-learners. We determined that non-learners struggled to explore the overall task space and perseverated on a single task strategy. However, non-learners did retain the skill that they had acquired, which indicated their capacity to learn was not the limiting factor, rather their ability to strategize. Furthermore, participants who reported having a more active lifestyle performed better on the task overall. This finding suggests that task success is based more on previous experience than on innate learning capability. We are now expanding this work to make the task playable online, including on mobile devices. Our initial work indicates that behavior on the online version of our task is similar to that on our laboratory version. With online access, we have begun to integrate the task into a large online cohort called MindCrowd, an internet-based Alzheimer's disease study that collects health information, genetic information, and cognitive assessments across the adult lifespan. Our preliminary analysis has demonstrated that performance on the discovery task is strongly linked to age and cognitive task performance. Additionally, performance on the task predicts individual APOE genotype, which has been shown to be predictive of dementia risk, while controlling for age, sex, education and cognitive status. These results highlight the potential utility of a discovery task to better understand individual differences, aging and dementia through an online platform.

The Effects of Individual Differences in Internal Representations on Conscious Processing and Performance in a Motor Task

Oliver R. Runswick, King's College London; Hettie Roebuck, University of Derby

Individuals can differ in their experiences of conscious thought, such as a tendency to represent thought processes with visual imagery or in the form of language. These differences in internal representations can also be evident during motor control, where conscious and verbalizable control of movements can negatively affect performance, while visualizations can be facilitative. The Internal Representation Questionnaire (IRQ) was developed to measure propensity to engage certain types of representations and includes factors related to imagery and verbalization. However, its ability to predict motor performance has not been tested. In this study 155 participants (105 female) completed the IRQ, movement specific reinvestment scale (MSRS), and performed a novel motor task, presented on the online platform Gorilla. Performance efficiency on the motor task and verbalized descriptions of the movement were measured before and after a period of practice. Significant improvements in performance across the practice period evidenced engagement in learning the task ($F = 37.8$; $p < .001$; $\eta p2 = .285$). The forced entry regression showed that the IRQ was a significant predictor of MSRS responses ($F4,114 = 6.8$, $p < .001$, $R2 = .192$, $R2Adj = .163$). Specifically, there was a significant positive relationship between IRQ verbal ($t = 3.6$, $df = 118$, $p < .001$) and orthographic ($t = 2.5$, $df = 118$, $p = .014$) factors with MSRS. IRQ and MSRS did not predict the verbalized motor task descriptions. However, IRQ factors of manipulational representation ($t = -2.7$, $df = 84$, $p = .008$) and visualization ($t = 2.96$, $df = 84$, $p = .004$) did predict performance efficiency in the motor task ($F6,78 = 2.36$, $p = .038$, $R2 = .154$, $R2Adj = .089$), but only when performed after practice. Results suggest there may be some conceptual overlap between internal verbalizations and reinvestment. The IRQ has potential to be a valuable tool for predicting motor performance by integrating measures of an individual's tendency to visualize or engage in verbal processing when learning new motor patterns.

Shedding Light on Individual Differences in Motor Performance: Interactive Effects of Motives and Incentives in the Laboratory and in the Field

Florian Müller, Friedrich Schiller University; Rouwen Cañal-Bruland, Friedrich Schiller University

Motive disposition theory (see Schultheiss & Brunstein, 2010) posits that differences in individuals' achievement, affiliation, and power motives affect their capacity to perceive performance, affiliative, or competitive contexts as rewarding. This notion has been used to explain individual differences in motor performance (Müller & Cañal-Bruland, 2020, for a review). Here we highlight recent studies from our lab that outline new research directions. For instance, Müller, Abad-Borger, Kellermann, Wellnitz, and Cañal-Bruland (2021) tested if a fit between motives and situational incentives moderates choking. Typical pressure manipulations use competitive or team settings representing prototypical power and affiliation incentives – thus we expected the affiliation (power) motive to be related to golf putting performance in team (competitive) settings. Also, task intrinsic performance feedback should appeal to those high in achievement. After familiarization, $N = 115$ participants completed a baseline block of golf putting, followed by an experimental block manipulating incentives (competition, team, control) between subjects. Results showed that affiliation and achievement were positively related to performance (variable error) under pressure, with no effects found for the power motive. Müller, Hocke and Cañal-Bruland (in prep) examined if motives may explain differences in elite ski-jump athletes' World Cup performance. Combining motive measures of $N = 19$ athletes with archival data on ski jump performance we tested whether a strong affiliation (power) motive is more advantageous in team (individual) competitions. Preliminary data analyses indicate that context indeed moderates the effects of affiliation on performance, thereby highlighting the role of personality differences in predicting motor performance variability. Together, our findings reveal the contribution individual differences in personality make to motor performance, even in elite athletes.

Taking a More Individually Focused Approach to the Study of Expertise

Mark Williams, Florida Institute for Human and Machine Cognition & University of Utah

Most of the research on expertise in sport and across other domains has largely been driven by cognitive psychology and its underlying paradigms. However, while there are exceptions, most notably the focus on deliberate practice, the prevailing approach remains one based on aggregating performance scores across many trials (i.e., to remove 'noise' or variability) and on establishing group norms in performance (and learning). While, by definition, true experts are 'outliers', and hard to find, it appears rather ironic that most of our knowledge on how experts may be differentiated from novices is based on the collective group norm. Moreover, our knowledge of how performance varies over repeated attempts (i.e., across time) in experts (and novices) is generally limited. So, while we argue that a characteristic of expertise is consistency in performance (and its underlying processes), this is rarely ever measured. Furthermore, we know almost nothing about how experts modify well-learned skills or acquire new skills and whether the paths they take and the processes involved are similar to those seen in novices and intermediate performers. In contrast to the current preference for establishing group norms, prior to the rise of cognitive psychology, the prevailing paradigm was driven by differential psychology, where the focus was on identifying individual differences in the processes that mediate performance and learning and how these changed over time. In this talk, I highlight the shortcomings involved when each approach is used in isolation and highlight the benefits that may be gained by combining the methodologies used by cognitive and differential psychologists to further our understanding of expertise and its acquisition. The benefits of such an integrated approach have implications for how we measure and enhance performance across many professional domains.

Sport and Exercise Psychology Symposia

'Sport Parenting': Evidence-Based Understanding of Unique and Relevant Psychosocial Experiences

Parents' Perceived Benefits and Subjective Task Values' Effects on 'Good Parenting' Within the Junior Lifeguard Program

Danielle Wong, University of Northern Colorado; Zachary McCarver, University of Northern Colorado; Megan Babkes Stellino, University of Northern Colorado

'Good parenting' is defined as socially and contextually specific parental provision of opportunities for their children believed to contribute to their positive youth development (PYD; Coakley, 2011; Coakley, 2006). Expectancy-value theory (Eccles et al., 1983) suggests activity choices are dependent upon perceived subjective task values of interest, enjoyment, attainment, utility, and relative cost. The Junior Lifeguard (JG) Program aims to provide youth an experience to promote positive development and learn skills like those of an ocean lifeguard. The purpose of this study was to examine the effects of parents' subjective task values on good parenting associated with providing their children opportunity in the JG Program. JG parents ($N = 253$, $M_{age} = 46$ years, 87.8% female) completed a survey that included multiple items that assessed their subjective task values and perceived benefits of the JG program in relation to 'good parenting'. Sequential regression analysis was conducted to explain the effects of perceived benefits in step one, and parent subjective task values in step two on perceived good parenting for providing their children the JG Program. Results of step one revealed physical activity benefits ($sr_{y(1\bullet2345)} = .25$, $p < .000$) was the only significant contributor accounting for 11.1% of the variance in good parenting. Step two revealed parents subjective task values significantly predicted good parenting ($rR^2 = .09$, $p < .001$; $sr_{y(1\bullet23456)} = .32$, $p < .000$) accounting for 20% of the variance in good parenting. Findings clarify how parents internalize specific contextual-based values of the JG program and establish evidence of how parents' perceived benefits and subjective task values in this specific context provoke perceptions of their own 'good parenting'. Discussion and conclusions will elucidate plausible parent rationalizations for why they provide specific youth sport-related opportunities to their children based on these findings.

"We're Paying Good Money for This": An Examination of Sport Parents' Views on Investment in Elite Sport Participation During the COVID-19 Pandemic

C. Ryan Dunn, Weber State University; Amand L. Hardiman, Utah State University; Travis E. Dorsch, Utah State University; Matthew Vierimaa, Acadia University; Keith Osai, Weber State University

Parents play an integral role in supporting their children's participation in youth sport. Of note, they collaborate with coaches, administrators, and athletes to provide instrumental, emotional, and informational support to their athletes (Peter, 2011; Turman, 2007). Yet, with the onset of the COVID-19 pandemic in Spring 2020, their involvement may have been modified. Schools were shuttered, leagues and tournaments were canceled, and the integration of regular training became complicated. Despite these widespread impacts, little research has investigated youth sport parents'

continued support of their children during the pandemic. Using qualitative data from family interviews with stakeholders from an elite youth volleyball club on the East Coast of the United States, the current study was designed to assess the views of parents (and children) on family and athlete experiences during a period of extraordinary stress. Data were collected through Zoom interviews with young athletes (Mage = 15.0, SD = 2.2) and their parents (Mage = 50.5, SD = 5.46). Interviews were transcribed verbatim and analyzed using Percy et al.'s (2015) generic qualitative inquiry to understand parents' (and athletes') perceptions of sport participation during the pandemic. Results highlight expectations of sport-based as well as character development-based outcomes from these stakeholders. Parents described the significant "investments" they have continued to make for their children in sport. Further, the preservation of, as well as modifications to, long-term objectives (e.g., positive socialization and pursuit of college scholarships) were recounted as the "new normal" of youth sport during and after the pandemic. Findings elucidate several core relationships among parent involvement, program design and delivery, and young athlete experiences and outcomes. Considering the homogeneity of the population under investigation, future studies should include assessments of sport parenting from a more diverse array of sports, locations, and family socio-demographic backgrounds.

"Cherish Watching Them Play. It'll be Over Before You Know It": Exploration of Retirement From 'Sport Parenting'

Megan Babkes Stellino, University of Northern Colorado; Julie A. Partridge, Southern Illinois University – Carbondale; Lindsey Leatherman, Southern Illinois University – Carbondale; Danielle Belcher, University of Northern Colorado; Samantha Stelpflug, University of Northern Colorado

'Sport parenting' retirement, like the transition out of sport for athletes, is an inevitable aspect of involvement in the sport context. Research on the experiences of athlete retirement for parents has revealed that the transition is challenging, dynamic and impactful, particularly regarding the relationship with their child and disengagement from the competitive athletic context (Brown et al., 2019; Lally & Kerr, 2008). Yet, evidence of how specific parental factors are affected by retirement remains limited. The purpose of this study was to explore the saliency and relationships of relevant psychosocial factors from parents' reflections of their past sport parenting experiences. Parents ($N = 86$, Mage = 50 years, 94% Moms, 87% White) of athletes from a variety of sports who recently ended their involvement responded to survey items about their former sport parent identity, investment, values, and emotions associated with their child's sport participation. Open-ended questions that solicited self-descriptions, nature of involvement, feelings about the end of their child's sport participation and advice for other sport parents were also asked. Significant positive associations emerged among levels of former 'sport parent identity', enjoyment, values derived, and extent of missing their child's athletic participation. Frequency, content and sentiment analyses revealed a variety of meaningful temporal-based, emotion-laded reflections and insights about parents' transition experiences. Most parents indicated opportunities for social interactions and watching their child play or compete as the aspects they missed most. In addition to financial cost and time investments, 'other parents' were cited as what former sport parents missed the least. Results from this study provide further empirical evidence of the saliency of the transition process on specific psychosocial aspects of sport parenting. Discussion will focus on how continued research is warranted to understand the relevant psychosocial outcomes from sport parent disengagement.

A Needs-Driven Approach to Athlete Identification, Selection, and Development

An Introduction to the Symposium

Joseph Baker, York University; Kathryn Johnston, York University

Researchers and practitioners working in sport settings often rely on models of athlete development for determining the appropriate allocation of training resources. These models are often criticized by the research community as being a) based on incomplete or outdated evidence, b) unidimensional, and/or c) reflecting designs that are too simplistic to capture the complexity of this phenomenon. Ultimately, this results in a profile and conceptualization of athlete development that is inadequate for both researchers and practitioners. Ideally, profiles of athlete development would be driven by data from within the program they are designed to inform and work within the constraints of this system. In this symposium, we describe an approach developed by experts from different disciplines (e.g., in talent identification, athlete development, neuropsychology, psychometrics, and statistics) and institutes who work at various levels in the athlete development system in Canada (e.g., youth sport to elite, adult sport performance). The goal of this initiative was to create an evidence-informed approach to the development of adolescent athletes in a high-performance athlete development pathway. This symposium includes three presentations. The first explores coaches' definitions and conceptualizations of athletic talent; the second considers the value of general cognitive capacities and testing for understanding athlete development and selection; and the third presentation focuses on emerging approaches for modeling and evaluating developments in this field. Finally, a renowned researcher in this area will provide their perspective as discussant.

What is Talent? Coaches' Perspectives on an Elusive Variable

Kathryn Johnston, York University

The word 'talent' is used to describe different things under different contexts. For better or worse, the processes of talent identification and talent selection operationalize those conceptualizations of 'talent' and ultimately lead to the (de)selection of an athlete from a sport program. Despite the commonality of these terms and processes, our understanding of what they mean and how they are used remains limited. To help address this void, this presentation has two main objectives (1) to investigate coaches' conceptualizations of talent in the context of their sport and (2) gain a better understanding of the information used by coaches when forming judgements for athlete selection. Results from studies of distance running coaches and collegiate-level coaches will be discussed. In general, coaches conceptualized talent as existing in multiple forms (called 'raw' and 'trained'), having physical and psychological components, and present in obvious and less-than-obvious ways. In terms of selection practices, there is heavy reliance on both subjective and objective information used when crafting judgments. Specifically, coaches mainly gather information using their coaches' eye and from objective information. The coaches acknowledge the 'coaches' eye' is an important tool for determining an athlete's ability, but also recognize how it can lead to errors in judgment. Findings emphasize the nuanced and complex conceptualizations of talent and reveal the need for a greater understanding if it is to be useful for improving athlete selection. Funding: Social Sciences and Humanities Research Council of Canada

Are We Under-Valuing the Role of Cognition in Athlete Development?

Magdalena Wojtowicz, York University

Cognition refers to "the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses". In sport, particularly interactive and interceptive sports, the brain is central to understanding elements of performance. However, discussions of athlete development and expertise have mainly focused on comparing specific

skills (e.g., perception and decision-making) across sport types or levels of skill/competition. Furthermore, there is a tendency to emphasize the role of cognitive skills from a 'software' (learned skills) versus 'hardware' (innate capacities) perspective. However, despite the widespread use of this 'software vs hardware' narrative, its value in the context of talent selection and athlete development is unknown since most prior work has focused on comparing adult athletes. Recently, there has been greater attention to the role of general cognitive capacities in high performance sport (e.g., Rahimi, Roberts, Baker & Wojtowicz, 2022). In this presentation, we will explore the potential value of considering a broaden perspective of cognition on athlete development, from general capacities like executive function and attention to more specific skills like pattern recognition, anticipation, and knowledge structure. From this perspective, general cognitive abilities may play important interactive or foundational roles in the development of domain-specific skills.

Embracing the Complicated Nature of "Scientifically Amazing Settings": Novel Approaches to Assessing and Tracking Athlete Development

Nick Wattie, Ontario Tech University

A basic assumption reflected in most contemporary approaches is that athlete development is a dynamic but generally progressive process. This process is undoubtedly complex and difficult to predict, but generally, the process (apart from extreme examples) is a progressive one. This does not imply linearity, as development and skill acquisition processes are best described as 'non-linear'. As many have also pointed out, researching athlete selection and development processes is further complicated by the small sample sizes of high-performance samples (i.e., small n research). This places unique pressures on those working and researching in high performance settings. In this presentation we will explore a range approaches and techniques for conceptualizing athlete development, and understanding the processes of athlete development. These approaches include conceptualizations of talent and athlete development, assumptions and conventions around statistical significance, type I and II error rates, as well as techniques such as n-of-1 trial designs, percentage of overlapping data procedures (e.g., improvement rate difference, percentage exceeding the median), and cluster analyses. All of these approaches, in one way or another, embrace the complicated nature of athlete development processes and outcomes in high-performance sport.

Understanding the Interdependent Nature of Persons and Contexts in Youth sport: Implications for Future Research, Design, and Delivery in Youth Sport

Amand L. Hardiman, Utah State University; Obidiah Adkinson, Ohio State University; Valeria Eckardt, German Sport University Cologne; Daniel J.M. Fleming, Utah State University

Most children and adolescents participate in some form of organized sport, and the outcomes that they experience are influenced by interactions with other persons as well as the broader contexts in which their participation occurs. To help better understand these influences, Dorsch and colleagues (2020) proposed a heuristic model that integrates the many components of the youth sport system. Within the model, the youth sport system is defined as "the set of interdependent persons (parents, siblings, peers, and coaches) and contexts (organizations, communities, and societies) that influence and are influenced by an athlete's behaviors, attitudes, experiences, and outcomes in youth sport" (p. 2). The purpose of this symposium is to present new sport and exercise psychology research that addresses the interdependent nature of persons and contexts in youth sport. The symposium will begin with a brief overview of the youth sport system. Four empirical studies will then be presented by graduate students from Canada, Germany, the United States, and the United Kingdom. The first study examines the backgrounds, values, and practices among youth sport coaches in Central Ohio and the need for contextualized trainings to address their diverse needs. The second study identifies a model of facilitators and barriers to the successful integration of parents into German professional youth soccer academies. The third study assesses the experiences of sport administrators and their role in keeping an elite volleyball club functional during the COVID-19 pandemic. The last study investigates parents' perceptions and attitudes about their children returning to sport following pandemic-related restrictions. After the four scientific presentations, a diverse panel of discussants will offer observations of the emerging research through research, applied, and community lenses. The continued pursuit of integrated knowledge in this research area is expected to enable more effective promotion of positive developmental experiences in youth sport.

Understanding the Backgrounds, Values, and Practices of Youth Sport Coaches in Central Ohio: A Need for Contextualized Trainings

Obidiah Atkinson, The Ohio State University; Dawn Anderson-Butcher, The Ohio State University; Jacqueline Goodway, The Ohio State University

Coaches are proximal to athlete development and influence the retention of youth in sport. A coach's role is complex and varies according to a range of contextual factors. Many coach studies, however, lack sufficient methodological description, have small sample sizes, focus on individual practices, and fail to account for the larger contexts in which coaches engage. This exploratory study examines the backgrounds, values, and practices among youth sport coaches in Central Ohio as part of The Aspen Institute's Project Play initiative. We explore the degree to which coaches' values and practices differ based on competition level, region (urban, suburban, rural), setting (school- or community-based), the gender of athletes and coaches, and type of sport (team or individual). A total of 461 coaches completed an online survey. Most coaches were male (71.3%), White/Caucasian (86.9%), 30 years of age or older (83.4%), coached youth who were mostly White/Caucasian (80.0%), between the ages of 11 to 17 years old (91.2%), participated in team sports (74.2%), and in school settings (77.4%). Results show that female coaches, and those coaching female and/or co-ed teams in competitive and community settings, reported developing life skills, building relationships with youth, and having fun as coaching behaviors that determine the success of a coach. Interestingly, male coaches, coaches of male teams in rural, suburban, developmental, and school settings indicated that performance-related outcomes (strong win-loss record, winning championships) were also important to the success of a coach. When asked to reflect on their positive coaching behaviors from the previous season, female coaches, and coaches of female athletes in urban regions were more likely to emphasize strong, caring relationships, use goal setting, and create a sense of belonging. Findings are in line with Dorsch and colleagues (2020) integrated model of the youth sport system, suggesting there is a need for contextualized trainings to address the diverse needs of coaches and the complexities of youth sport.

A Grounded Theory of Parent Integration in German Professional Youth Soccer Academies

Valeria C. Eckardt, German Sport University Cologne; Travis E. Dorsch, Utah State University

Children's outcomes in youth sport are influenced by social relationships and the interactions athletes have with other individuals. To achieve a successful sport experience, clubs and coaches often strive to engage

parents toward the betterment and well-being of the athletic child. However, theory and practice are lacking with regard to how social agents in the youth sport system coordinate. Utilizing Dorsch and colleagues' (2020) framework for an integrated understanding of the youth sport system, the present study was designed to identify a model of facilitators and barriers to a successful integration of parents into the professional German youth soccer academy system. Theoretical and purposive sampling were employed to recruit social agents of U8 to U17 teams from 15 German youth soccer academies. In-depth, semi-structured interviews with 15 administrators (6 females; Mage = 42.00, SD = 10.91), 12 coaches (all male; Mage = 40.82, SD = 11.92) and 9 parents (3 females, 2 dyads; Mage = 44.82, SD = 5.56) were conducted and analyzed following the principles of constructivist grounded theory methodology (Charmaz, 2006). Results suggest that the successful integration of parents into professional youth soccer academies is a process of trial-and-error for coaches, administrators, and parents themselves. In the present study, relationships between social agents were characterized by interdependence and reciprocity while club stakeholders aimed to maintain a professional distance from parents. Findings elucidate several facilitating psychological factors such as mutual trust, understanding, honest communication, and appreciation. Differences in academies, available economic resources, the sociocultural composition of families, and the nature of parental involvement were identified as potential barriers to the successful integration of parents. We recommend that clubs develop a professional management plan and evidence-based guidelines for coaches on parent integration to foster a positive youth sport environment.

An Examination of Youth Sport Leaders' Efforts to Keep an Elite Youth Volleyball Club Operational During the Global COVID-19 Pandemic

Amand L. Hardiman, Utah State University; Travis E. Dorsch, Utah State University; Matthew Vierimaa, Acadia University

Sport administrators play a salient role in the design and delivery of youth sport programming, while trying to promote positive sport outcomes and experiences for athletes, coaches, and parents. In doing so, they also strive to enhance the organizational effectiveness and culture of the youth sport programs they direct. However, in 2020 the COVID-19 pandemic caused an abrupt suspension of youth sport. As a result, sport administrators had to adjust clubs' programming, procedures, and policies in an attempt to remain stable until sport returned. Despite this relatively ubiquitous experience, little research has investigated youth sport administrators' efforts to keep sport operational during the COVID-19 pandemic. Using an integrated model of the youth sport system (Dorsch et al., 2020), the current study was designed to assess the experiences and roles of youth sport administrators during COVID-19. In-depth semi-structured interviews were conducted online with three administrators (Mage = 40.33, SD = 5.03) from an elite youth volleyball club in the mid-Atlantic region of United States. Interviews were transcribed verbatim and analyzed using Braun and Clark's (2012) six-step thematic analysis in an effort to understand the experiences of these key stakeholders. Results suggest that these administrators experienced various positive and negative psychosocial outcomes in relation to personal challenges (i.e., families and employment), the uncertainty of return-to-sport protocols, and how to restructure organizational policies, procedures, and finances. Other results highlighted the importance of communication pathways between administrators and parents, coaches, and athletes as administrators attempted to defuse conflict and maintain strong club cohesion and culture. Lastly, administrator decision-making before and during COVID-19 played a salient factor in the vitality of this youth sport organization. Results suggest that future research should be conducted to better understand the well-being of youth sport administrators.

The Impact of Socioeconomic Status on children's Return to Sport Post-COVID-19: The Perceptions of Sport Parents

Daniel J.M. Fleming, Utah State University; Travis E. Dorsch, Utah State University; Sarfaraz Serang, Utah State University; Amand L. Hardiman, Utah State University; Jordan A. Blazo, Louisiana Tech University

Sport presents a unique context for youth development. Appropriately constructed youth sport settings have the potential to yield positive behavioral and psychosocial outcomes. Despite this, participation in youth sport during the COVID-19 pandemic has also been marked by potential negative outcomes, specifically the health of athletes and their families. Although most families have chosen to return to youth sport in some capacity, little is known about the decision-making processes families have used to weigh the costs and benefits of returning to sport. Participants in the present study were 6183 American parents (Mage = 39.31, SD = 8.9) with at least one child active in organized youth sport. Participants identified as 58.9% White, 18.1% Hispanic, Latino, or Spanish origin, 13.38% Black or African American, 5.76% Asian, 1.99% Multiracial, 1.00% American Indian or Alaskan Native, 0.27% prefer not to say, 0.27% other, 0.23% Native Hawaiian or Pacific Islander. Participants completed a single-time-point questionnaire that collected demographic information and responses related to how serious they perceived barriers to returning to sport to be. Structural regression was used to examine the relationships between a range of sociodemographic factors and barriers to returning. Results suggest that those from minoritized groups (B = 0.36, p < .01) reported higher levels of concern over health-related barriers (Asian, B = 0.44, p < .05; Black or African American, B = 0.38, p < .05), and structural barriers (Urban Neighborhood, B = 0.37, p <.001) to returning to sport. The present results speak to the potential influence of sociohistorical and structural systems on the perceptions of sport parents in relation to sport participation, safety, and accessibility. In line with Dorsch and colleagues' (2020) integrated model of the youth sport system, findings highlight the importance of addressing societal inequalities in healthcare access and sport provision, particularly in the wake of a worldwide health crisis.

Sport and Exercise Psychology & Motor Development Symposia

Scaling-up a Comprehensive School-Based Physical Activity Intervention: Development, Evaluation, and Dissemination of the iPLAY Program

Findings From the iPLAY Cluster Randomized Controlled Trial

Chris Lonsdale, Australian Catholic University

High levels of physical inactivity have led to significant decreases in children's fitness in recent decades. Comprehensive school-based physical activity programs are a promising avenue for addressing declining fitness levels, but effective, affordable interventions have not been delivered at scale. We developed a teacher education intervention, based largely on self-determination theory principles and recruited 137 schools for delivery and evaluation. Within this sample, we evaluated the effectiveness in a cluster randomized controlled trial in a sub-sample of 22 elementary schools. Eleven schools received the iPLAY intervention, with the other 11 schools acting as a waitlist control. We evaluated children's cardiorespiratory fitness (primary outcome) using the multistage 20m shuttle run,

physical activity with accelerometers, and students' enjoyment and well-being with questionnaires. Students (N=1188, 49% girls; mean age = 8.85 years) provided baseline primary outcome data. At 12 months, the number of 20-m shuttle runs increased by more laps in the intervention schools than in the control schools adjusted difference = 1.20 laps; 95% CI, 0.17-2.24 laps). By 24 months, the adjusted difference was 2.22 laps (95% CI, 0.89-3.55 laps). We observed improvements in children's physical activity during school breaks at 12 and 24 months, and children's perceived teacher support at 24 months. We did not observe significant changes in overall physical activity (accelerometer or self-report), enjoyment, or well-being within the randomized trial sample. However, when data were pooled with the other schools receiving the intervention (outside the trial), we observed significant intervention effects compared to the control group in children's self-reported wellbeing, enjoyment of physical activity, self-reported physical activity, and participation in team sports. Our findings demonstrate that the iPLAY intervention is effective at improving children's fitness, even when delivered in a large number of schools. Funding source: NHMRC, NSW Department of Education.

Reach, Effectiveness, Adoption, Implementation, and Maintenance of the Internet-Based Professional Learning to Help Teachers to Support Activity in Youth (iPLAY) Intervention

David Lubans, Australian Catholic University

Whole-of-school programs are considered one of eight investments that work for physical activity promotion, but few progress beyond efficacy testing to implementation at-scale. The purpose of this study was to evaluate the state-wide dissemination of the 'Internet-based Professional Learning to help teachers support Activity in Youth'(iPLAY) program using the RE-AIM framework. Data were collected using a variety of methods between April 2016 and June 2021. RE-AIM was operationalized as: (i) Reach- the estimated number, proportion, and representativeness of students who were exposed to the iPLAY program, (ii) Effectiveness- the impact of the iPLAY program on self-reported student outcomes in a sub-sample of schools, (iii) Adoption- the total number and representativeness of schools and teachers that participated in the iPLAY program, and the proportion of teachers who completed each aspect of the training, (iv) Implementation- the extent to which the curricula and non-curricula components of the program were delivered as intended, (v) Maintenance- the extent to which the iPLAY program became institutionalized in schools, as well as the barriers and facilitators to implementation. Reach: The iPLAY program reached ~31,000 students from 115 primary schools in the dissemination group. Effectiveness: Compared to students in the control group, students in the iPLAY dissemination group reported improvements in a range of outcomes, such as well-being, physical activity, enjoyment of PE, and teacher needs supportive behaviors during PE at 24-months[3] [DL4]. Adoption: 115 schools, representing 7% of all government schools in NSW, received the iPLAY program. Implementation: 59% and 55% of schools implemented the curricular and non-curricular strategies as intended. Maintenance: Based on interviews with Principals, Leaders and teachers, changes in teacher practices and school culture resulting from the iPLAY program were sustained in schools. The iPLAY program had extensive reach and adoption in NSW primary schools. The majority of schools implemented the intervention as intended and effectiveness data suggest the positive effects observed in the cluster RCT where sustained when the intervention was delivered at-scale.

How Cognitive Load Theory and SUCCESS Principles Helped iPLAY Scale-up, While Keeping an Engaging Learning Environment With High Fidelity

Michael Noetel, Australian Catholic University

Delivering interventions at scale with high fidelity is a complex problem. Interventionists need to balance delivering content with demonstrated efficacy with engaging participants to ensure adoption. Multimedia-based interventions can be a good solution to this problem, as they ensure consistent delivery of content and allow for a flexible learning environment. Creating multimedia which engages participants is challenging. In this presentation, we describe the research-informed and theory-based process used to design the multimedia for the iPLAY intervention, in order to scale the intervention from 8 schools to 137. The iPLAY multimedia design was based on educational meta-analyses, including those we conducted. For example, we found that videos are as good, if not better, than traditional instruction in adult learning environments. We found ten multimedia design principles—such as highlighting important information, deleting irrelevant content, using simple language, and avoiding text when images will do—each of which increase learning with small-to-moderate effect sizes. We also drew on 'health narratives' literature emphasising the importance of stories that correct misconceptions, ideally with empathy toward the audience, and induction of helpful emotions. These low-cost strategies to improve the online educational experience was central to the success of the intervention at scale, especially given the blended learning design of iPLAY. Those strategies may be useful for other researchers and practitioners to adopt when trying to change behaviour at scale.

Adapting a Comprehensive School Physical Activity Program to Meet Diverse Needs: Rationale and Development of iPLAY for Inclusion and iPLAY for All

Taren Sanders, Australian Catholic University

In previous studies, we have demonstrated that the iPLAY comprehensive school-based physical activity program is 1) effective at improving cardiorespiratory fitness; 2) can be delivered at scale with good adoption and implementation; and 3) is low cost. Yet, quality interventions require continuous development and adaptation. In this presentation, we provide the rationale and development process for two subsequent programs derived from the original iPLAY intervention. The first, iPLAY for Inclusion, focused on adapting the intervention to meet the additional needs of teachers of students with intellectual disabilities. Physical inactivity is a particularly big problem for children with intellectual disabilities, as they participate in less physical activity than the rest of the population. To meet this need, we developed additional strategies and resources to help teachers learn how to adapt the curricular and non-curricular components of the iPLAY program for youth with intellectual disabilities. These included additional work on varying equipment and the environment, adapting rules, teaching style, and managing distress. In the second adaptation, iPLAY for All, we are developing intervention strategies to meet girls' needs. Moderation analysis of the original iPLAY intervention indicated that while the intervention was effective on average, some groups—including girls—receive less of the benefit than others. The imbalance of benefits is a common problem in school-based physical activity interventions, but solutions exist. Using strategies that have proven effective in previous research, we are adapting iPLAY to meet all students' needs.

Free Communications: Verbal and Posters

Motor Development Abstracts

Atypical Gaze in Children With Autism Spectrum Disorder During an Active Balance Task

Venkata Naga Pradeep Ambati, California State University, San Bernardino

Unusual gaze behavior in children with Autism Spectrum Disorder (ASD) was reported very early in the literature. This pattern of atypical gaze in children with ASD may be advantageous in certain tasks such as embedded figures test but may lead to difficulty in other types of tasks such as motor skills. Therefore, the current study examined gaze behavior in children with ASD and typically developing children while performing an active balance task on the Wii balance board. 8 children diagnosed with high functioning ASD with an average age of 14±1.6 years were recruited from Center for Autism Spectrum disorders at Southern Illinois University (SIU) Carbondale. 9 typically developing children with an average age of 13±1 years were recruited by posting fliers on SIU Carbondale campus. They were fitted with an eye tracking device (Tobii) before performing the balance task using Wii balance board. Eye movements were recorded at 60 Hz during the soccer game on Wii balance board. Mean total visit duration, total visit count, first fixation duration, and Wii soccer game scores were calculated for each participant and trial. There was no significant difference in the game scores between the two groups, however evidence indicates differences in gaze behavior particularly total fixation durations on the main area of interest (center AOI). While performing the active balance task children with ASD spent relatively less time looking at the center of the screen compared to typically developing children. There are two possible reasons that could potentially explain shorter fixation durations in kids with ASD. First, shorter fixation durations in ASD compared to TD group, could be indicative of how our ASD group had enhanced perceptual processing. The second possibility for shorter total fixation duration in ASD is that they are more scattered in their fixations. Whether shorter fixation durations were because of enhanced perceptual processing or a deficiency in their ability to plan, there was no advantage or disadvantage observed in the performance of the Wii-fit game.

Gaze Behavior During Embedded Figures Test in Children Diagnosed With High Functioning Autism Spectrum Disorder

Venkata Naga Pradeep Ambati, California State University, San Bernardino; Jason Reimer, California State University, San Bernardino

Unusual gaze behavior in children with Autism spectrum disorder (ASD) was reported very early in the literature. Consistent with previous reports, recent work has repeatedly shown atypical visual-spatial perception associated with ASD by enhanced performance on a variety of experimental tasks. In particular, individuals with ASD have been shown to excel at Embedded figures test (EFT). Although superior EFT performance in ASD is well replicated, the underlying mechanisms remain uncertain. In order to better understand accelerated performance in EFT in children with ASD, the present study will examine various gaze variables in this group while they work on EFT. Children in the age range of 10-13 years diagnosed with ASD were recruited from the University Center for Developmental Disabilities at California State University, San Bernardino. Typically developing (TD) children in the same age range were recruited using fliers posted on CSUSB campus. We are using a screen-based eye tracker to record participants' point of gaze at 250 Hz. Two cameras in the eye tracker capture images of both eyes for robust accurate measurement of eye gaze and eye position in 3D space, as well as pupil diameter. Embedded figures test is presented to the participants on the laptop using E-prime software. We hypothesize a superior performance in ASD compared to TD developing children in our modified EFT. A significantly less response time in ASD compared to TD children in the test would indicate enhanced performance in EFT. We further hypothesize that kids with ASD will have fewer fixations and/or shorter fixation durations compared to typically developing kids. Fewer number of fixations along with shorter fixation durations indicate enhanced visual perception providing support to both Weak Central Coherence (WCC) and Enhanced Perceptual Functioning (EPF) models. Additionally, an equivalent performance in baseline condition of EFT would support EPF model. A significantly poor performance in baseline condition for ASD would provide support for WCC theory.

Assessing Motor Development in Minimally Verbal Autistic Children in a Virtual Research Setting: From Feasibility to Fruition

Maria J. Ayoub, Boston University; Laura Keegan, Boston University; Michele Z. Luo, Boston University; Tzu-Wen Chou, Boston University; Simone V. Gill, Boston University

Amidst the COVID-19 pandemic and risk of in-person data collection, motor development researchers have been prompted to reconsider their study designs and protocols. This presentation will discuss the feasibility of a study involving remote, virtual data collection without lab equipment or extensive set-up. The purpose of this study was to assess motor development and performance in minimally verbal children with Autism Spectrum Disorder ($n = 105$). We selected gross motor tasks that were suitable for assessment via Zoom Video Communications™: 1) walking back and forth along a premeasured space in participants' homes, 2) performing tandem walking along the same distance, and 3) balancing on one leg. Parents assisted in experimental set-up and facilitation through an instructional video and real-time guidance from research assistants. Number of steps taken and behavioral measures, such as toe-walking, were coded via DataVyu™. Preliminary analyses of 60 processed participants revealed that 31 participants displayed 70% or more "successful" walking trials (i.e., producing either spatiotemporal or behavioral data). Additionally, 20 participants were able to attempt tandem walking, and 50 participants were able to attempt unipedal balance (albeit, often while using internal or external support). Only 13 participants had majority "unsuccessful" trials (i.e., expressed behaviors coded as "other") across all tasks, typically due to internal (e.g., fatigue, lack of motivation) or external (e.g., noisy environment) factors. 4 participants could not be processed due to time lags in the video data. We believe that recruitment and participation were influenced by the convenience of collecting data at home with minimal equipment, and found that parents were able to assist in the collection process and maintain their children's level of engagement. We conclude that virtual data collection to assess motor development in autistic children is both feasible and fruitful, producing meaningful movement data while minimizing COVID-19 risk among researchers and participants. Funding source: NIH P50DC018006 (PI: Tager-Flusberg).

Assessing the Intersection of Cognitive and Motor Performance in Autistic Children: A Neuroimaging, Dual-Task Paradigm Proposal

Maria J. Ayoub, Boston University; Simone V. Gill, Boston University

Autism Spectrum Disorder (ASD), while commonly characterized by differences in social communication and repetitive patterns of interests and behaviors, is also marked by cognitive and motor impairments. Limited research has examined walking in ASD through a dual-task (DT) paradigm, which would allow for examination of the interaction between motor performance and cognition. The dual-task walking (DTW) paradigm has been used to evaluate the intersection of cognitive and motor performance in clinical populations that experience both cognitive and motor impairments, and much of this research has utilized functional near-infrared spectroscopy (fNIRS) in order to gauge the cognitive resources recruited during DTW. Few studies have used the DTW paradigm to assess cognitive engagement and motor performance in children with ASD. Although fNIRS is becoming increasingly popular in ASD research, there are currently no studies that utilize fNIRS during walking, much less DTW, in this population. The purpose of this proposed study is to examine changes in cognitive demand and motor performance with respect to spatial and cognitive dual task constraints during walking in autistic children (AC) and non-autistic children (NAC). As participants walk, they will face a spatial constraint (obstacle crossing), a cognitive constraint (playing a categorization game on a phone), and both constraints simultaneously. fNIRS will be utilized in order to assess changes in oxygenated hemoglobin (HbO2) concentration in the prefrontal cortex, and the Protokinetics Zeno Walkway™ will be used to calculate and assess various measures of walking, including step length, step width, stride length, velocity, and cadence. It is hypothesized that both NAC and AC will exhibit increases in HbO2 concentration during DT conditions, but AC will experience greater increases due to higher cognitive demand. Additionally, compared to NAC, AC will experience greater deficits in walking performance during DT conditions.

Parental Experiences and Affordances for Motor Development in Youth With Visual Impairments and Severe Disabilities

Pamela Beach, SUNY Brockport; Lauren Lieberman, SUNY Brockport; Michelle Grenier, University of New Hampshire

Many physical education (PE) teachers and teachers of students with visual impairments (VI) have difficulties including children with VI and additional disabilities. This places a burden upon parents to be more involved in their child's motor development. By creating affordances for physical activity, parents can encourage their child to lead a physically active lifestyle. Grounded in ecological psychology, the experiences of parents of youth with VI and additional disabilities in their child's PE were examined. A survey was developed and validated by experts in the field. Seventy-four parents/guardians of youth with VI and moderate to severe disabilities participated, 25 male and 49 female. Mean child age was 10.1 years ($SD = 3.66$ years) including 53 males and 22 females. Over half participated in Adapted PE, and 34.7% participated in general PE, with 40% of general PE participating without restrictions and 60% with the assistance of a paraeducator. Only 11.1% participated in PE in a special school (e.g., school for the blind). Most children participated in adapted PE (78%), however, only 50% of parents were satisfied with their child's PE experiences. Several barriers to successful participation in PE were expressed including safety concerns, lack of support personnel, and lack of adaptations. Most parents were actively involved with their child at home and in the community and were interested in learning strategies to effectively engage in physical activities with their child. Parents were also interested in training to provide more support with sport and physical activity for their child. Their top training interests were support personnel, adapted sports, modified equipment, aquatics, and recreational activities. The findings fulfill a gap in the literature by revealing possible affordances to support PE and motor development in youth with VI and moderate to severe disabilities. The parents' perceptions shared in this study should inform future research and practical applications focusing upon improving services for these children. Funding source: Lavelle Foundation.

Fundamental Movement Skills of 3-to-5-Year-Old Children With and Without a Chronic Physical Illness

Chloe Bedard, University of Waterloo; Sara King-Dowling, The Children's Hospital of Philadelphia; Brian W. Timmons, McMaster University; Mark A. Ferro, University of Waterloo

Approximately, 25% of children have a chronic physical illness and are at risk for numerous negative health sequalae; however limited data is available about their risk of poor motor skills, which could precipitate lower levels of physical activity, poorer self-esteem, lower levels of cognitive control, and poorer social function. The purpose of this study was to compare the gross motor skills (GMS) of children with a chronic physical illness to their healthy peers. Data for children with a chronic physical illness come from the Multimorbidity in Children and Youth Across the Life Course (MY LIFE) study and comparative data from children without a physical illness come from the Health Outcomes and Physical activity in Preschoolers (HOPP) study. Both MY LIFE and HOPP included children ages 3 to 5 years and used the Peabody Development Motor Scales – 2nd edition to assess GMS (stationary, locomotor, and object control). Participants from HOPP were sex- and age-matched (within 1 month) to participants from MY LIFE (20 male and 15 female pairs; $M_{age} = 53.0 \pm 9.8$ months). The most prevalent physical illnesses were rheumatic diseases (34%), cystic fibrosis (14%), dermatological conditions (14%), and asthma/allergies (11%). GMS scores were 'average or above' for 53% of children with a physical illness compared to 91% of children without a physical illness ($p = .003$). Matched-paired t-tests detected significant differences in total gross motor scores ($d_z = -0.35$), locomotor ($d_z = -0.31$), and object control ($d_z = -0.39$) raw scores with healthy children exhibiting better motor skills, and no significant difference in stationary subscale raw scores ($d_z = -0.19$). This skill gap may increase burden on children with physical illness and given the relationship between motor skills and physical and mental health, future research should examine if these motor deficits mediate the onset of mental illness. GMS should be assessed longitudinally to establish if the skill gap widens with age and investigate potential interventions to improve GMS of children with physical illness. Funding source: Canadian Institutes of Health Research.

Examining Moderate to Vigorous Physical Activity in Children Aged 4 to 11 Years

Dimetri Brandon, The Ohio State University; Jacqueline Goodway, The Ohio State University; David Stodden, University of South Carolina; Ali Brian, University of South Carolina; Larissa True, New Mexico State University; Rick Ferkel, Central Michigan University; Ruri Famelia, The Ohio State University; Obidiah Atkinson, The Ohio State University; Blaize Shiebler, The Ohio State University; Sue Sutherland, The Ohio State University; John Taylor, The Ohio State University

Research has shown the importance of moderate-to-vigorous physical activity (MVPA) toward health and wellbeing. However, many children, especially those from underserved neighborhoods, do not accumulate the necessary MVPA. What is less clear are the factors that contribute to a child's engagement in MVPA. This study: 1) examined gender and age-

related changes in MVPA, and 2) actual and perceived motor competence factors that predicted MVPA in children. A total of 393 participants (203 girls) across early childhood (EC:4-5 yrs, $n = 131$), middle childhood (MC:7-8 yrs, $n = 129$) and later childhood (LC:10-11 yrs, $n = 133$) were assessed on: 1) Physical Activity via 5-day accelerometry, 2) Motor Skill Competence using object control standard scores (OCSS), locomotor standard scores (LOCSS) from the TGMD-2, jumped distance scaled to height (JumpHt%), 3) Cardiovascular Fitness (CVF) using the Pacer test, 4) Perceived Motor Competence (PMC) using Harter's physical/ athletic competence subscale, and 4) BMI. A 3 Age X 2 Gender ANOVA on MVPA revealed significant Gender ($p < .001$) and Age ($p < .001$) main effects but a nonsignificant interaction. Boys had more MVPA ($M = 54.34$ mins) than girls ($M = 41.68$ mins). Follow-up Tukey analysis for Age revealed children in EC had significantly more mins of MVPA per day than children in MC and LC. No significant differences were found in MVPA between MC and LC. A linear regression with gender, age category, BMI, LOCSS, OCSS, JumpHt%, and PMC significantly predicted 25% of the variance in MVPA ($R^2 = .25$, $F(7,380) = 17546$, $p < .001$. Gender ($p < .001$), Age ($p < .001$) and OCSS ($p < .001$) were the only significant predictors. Findings highlight dramatic declines in MVPA from EC to MC, with these declines in MVPA occurring much earlier than previously thought. Interestingly OCSS was a significant predictor of MVPA and not LOCSS. Thus, improving OC skills may be a novel way to increase MVPA in children. These data have implications for the health and wellbeing of children and for practitioners who work with children in physical activity settings.

Bringing S.M.I.L.E. Home: A Pilot Feasibility Study of an At-Home Adapted Physical Activity Program

Emily Bremer, Acadia University; Nikki Matthews, Acadia University; Roxanne Seaman, Acadia University

The Acadia University Sensory Motor Instructional Leadership Experience (S.M.I.L.E.) Program provides persons with disabilities a unique physical activity experience guided by university student-volunteers. In response to COVID-19, a home-based S.M.I.L.E. program was developed and pilot-tested during the 2020-2021 academic year. Home-based S.M.I.L.E. included activities to be completed by participants on their own and online group sessions. A case study, using a mixed methodology, was used to explore program feasibility and acceptability, along with changes in participants' physical literacy and physical activity. Participants' caregivers completed pre- and post-surveys and weekly checklists during the 8-week fall session of S.M.I.L.E. and a subset ($n = 7$) participated in a post-program interview. The study included 16 S.M.I.L.E. participants ($n = 9$ females) between 7-31 years of age and their caregivers ($n = 15$). One participant lived independently and completed all study measures on their own behalf. There was an 81.25% completion rate of the weekly checklists. Participants reported completing the at-home program activities a median of two of the eight weeks (range = 0-8). On weeks where participants completed the activities, they completed them on average two days per week. Participants reported a high level of enjoyment ($M = 8.67/10$) and moderate level of ease ($M = 5.31/10$) in completing the activities. The most common reasons for activities not being completed were that the participant wasn't interested or didn't have time. Results from the pre-post survey indicated no significant changes in participants' physical literacy ($p > .05$, $d = .07$) or leisure-time physical activity ($p > .05$, $d = .13$). Despite lower-than-desired participation, post-interviews revealed positive outcomes including providing social connection and being able to participate from any location. Further implications including positives, negatives, and next steps for developing and testing home-based adapted physical activity programming will be discussed. Funding source: Special Olympics Canada.

What is the Goal of Adapted Physical Education Service-Learning Programs in the United States?

Layne Case, University of South Carolina; Joonkoo Yun, East Carolina University; Megan MacDonald, Oregon State University; Bridget Hatfield, Oregon State University; Samuel W. Logan, Oregon State University

Many children with disabilities demonstrate low competence in fundamental motor skills (FMS) compared to children without disabilities. Children with disabilities may participate in university-based, adapted physical education (APE) service-learning programs to improve FMS. However, research that examines APE service-learning primarily focuses on the experiences of university students (student-centered) and does not explore how people with disabilities are involved (disability-centered). Service-learning is intended to be mutually beneficial for and equally considerate of both students and participants. To improve FMS intervention within APE service-learning, an overview of existing program goals and activities should be studied. The present study therefore (1) identified the goals of APE service-learning across universities in the United States and (2) examined the implementation of several disability-centered vs. student-centered recommended practices. Participants included 165 faculty or graduate students involved in APE service-learning. Participants completed an online survey designed to collect descriptive data (e.g., program goals) and evaluate the use of practices that are student-centered (e.g., voluntary involvement) vs. disability-centered (e.g., opportunities for choice). Descriptive trends reveal wide variability in program characteristics, with only half of participants ($n = 82$, 49.7%, 95% CI [41.8%, 57.6%]) indicating increased FMS competence as a main goal for people with disabilities. Additionally, results of a Wilcoxon signed-rank test revealed that more student-centered practices were implemented than disability-centered practices across programs ($Z = -10.45$, $p < .001$). Considering the value of FMS and that many children with disabilities demonstrate low FMS competence, APE service-learning should prioritize motor development as a primary objective and plan accordingly. In addition, although service-learning is an important training tool for students, compliance with disability-centered best practices should be improved. Funding source: United States Department of Education, Office of Special Education Programs (H325D160023), PIs: Joonkoo Yun, PhD and Megan MacDonald, PhD.

Profiles of Physical Fitness, and Actual and Perceived Motor Competence: Differences in Motivation and Organized Sports Participation

Eline Coppens, Ghent University; Leen Haerens, Ghent University; Elisa Lefever, Ghent University; Julie Galle, Ghent University; Matthieu Lenoir, Ghent University; An De Meester, University of South Carolina

This study identified profiles in children based on physical fitness (PF), actual motor competence (AMC) and perceived motor competence (PMC), and examined differences among these profiles in autonomous motivation toward sports as well as organized sports participation (OSP). Children's ($N = 414$; 203 boys; $M_{age} = 8.95 \pm .81$ yrs) PF, AMC, PMC, and autonomous motivation were measured using valid assessment tools. OSP was assessed by means of a binary question (i.e., yes/no). Results revealed that 69.8% of our sample was involved in organized sports at the moment of testing. Cluster analyses revealed five different profiles, that were labelled based on relative (i.e., compared to the study sample) levels of PF, AMC and PMC, respectively. A cluster variable was labelled as high (H; z-score > +.50), average (A; -.50 ≤ z-score ≤ +.50), or low (L; z-score < -.50), based on the z-scores. Three profiles showed convergent levels of PF, AMC and PMC (i.e., LLL, AAA, HHA) and two profiles demonstrated partially convergent levels (i.e., LLH and AAL). Interestingly, the levels of PF and AMC are mutually correlated in all profiles, confirming the strong

relationship between these two variables. No significant differences among profiles were found in terms of age ($p = .36$) or gender ($p = 0.11$). The one-way MANOVA revealed significant differences among profiles for autonomous motivation ($p < .001$) with children in the LLL and AAL cluster scoring significantly lower than children in the LLH, AAA and HHA cluster. Since the two profiles with relatively low PMC also reveal lower autonomous motivation toward sports, our results indicate that PMC is crucial when it comes to autonomous motivation toward sports. With respect to OSP, significant differences were found across profiles ($p = .003$), with higher participation rates for children with average to high levels of AMC. Interestingly, high levels of PMC seem not to compensate for relatively low levels of PF and AMC in terms of OSP. Overall, our findings highlight the synergistic effect of promoting PF, AMC and PMC simultaneously.

Learning to Cycle: The Triumph of the Early Years Riding the Balance Bike

Rita Cordovil, Universidade de Lisboa; Cristiana Mercê, Universidade de Lisboa; Marco Branco, Universidade de Lisboa; David Catela, Instituto Politécnico de Santarém; Frederico Lopes, Universidade de Lisboa

The benefits of cycling are highly recognized, but the popularity of this foundational movement skill, and the environmental factors that promote its practice have varied across cultures and time. This variability potentially influences the importance placed on learning to cycle. In the L2Cycle international survey (9589 responses, covering 3 generations of adults and children, living in 10 countries), we found that age to learn how to cycle differs across geographical locations ($F(9, 8628) = 90.17$, $p < .001$, $\eta_p^2 = .086$) and the generation of birth ($F(2, 8628) = 47.21$, $p < .001$, $\eta_p^2 = .122$), with a declining trend among generations (Gen. X > Gen. Y > Gen. Z) (all ps < .001). Different environmental, individual and task constraints influence cycling learning age. The type of bicycle used to learn (training wheels vs. balance bike) is an important task constraint that started to gain attention with the rising popularity of the balance bike. Portuguese data from the L2Cycle survey (2005 responses) indicate that when the balance bike was used, children learned to cycle at a younger age ($M = 4.16 \pm 1.34$ years) than when the bike with training wheels was used ($M = 5.97 \pm 2.16$ years) ($p<0.001$). A small pilot intervention with 25 children ($M = 6.08 \pm 1.19$ years), who did not previously know how to cycle, seems to confirm these results. Children were divided in two practice groups: training wheels ($n = 12$) or balance bike ($n = 13$). Each group had 6 sessions with its training bike, followed by four sessions with traditional bike (with pedals and no training wheels). The intervention had a success rate of 100% for children in the balance bikes group and of 75% for children in training wheels group. The former also took less time to acquire independent cycling than the later ($U = 31.00$, $p = 0.007$). The fact that the balance bike improves balance from an early stage, not focusing on the pedaling coordination first may be the key for its success. Thus, it seems that learning how to cycle from an early age with the balance bike seems to be an important asset for the development of early motor skills. Funding source: Portuguese Foundation for Science and Technology, under Grant UIDB/00447/2020 to CIPER (unit 447) and UID/CED/04748/2020 to CIEQV.

Difference of Leg Movement Control in Infants With Typical Development and Infants Born Preterm During a Contingency Learning Process

Weiyang Deng, University of Southern California; Barbara Sargent, University of Southern California; Douglas Vanderbilt, Children's Hospital Los Angeles; Kathryn Havens, University of Southern California; Marcelo Rosales, University of Southern California; Christine Mirzaian, Children's Hospital Los Angeles; Jose Carlos Pulido, Universidad Carlos III de Madrid; Maja J. Matarić, University of Southern California; Beth A. Smith, Children's Hospital Los Angeles

Leg movement control during infancy is related to walking development. Previous studies show differences of leg movement patterns between infants with typical development (TD) and infants born preterm (PT). To create appropriate interventions, the first step is to understand the difference of leg movement control strategies between the two groups. We compared the learning process of leg movement control between infants born PT and infants with TD during a contingency learning paradigm through 1) time needed to reach the performer criteria, 2) quantity of movements, 3) linear variability (inter-quartile range) and nonlinear variability (sample entropy) of leg movements the performers made during the contingency period. Twenty infants with TD and 10 infants born PT participated at 6 to 8 months of (corrected) age. An infant-sized humanoid robot moved its legs and made laughing sound when infants made right leg movements with acceleration above individualized contingency threshold. The study consisted of 2-min baseline (no reinforcement), 8-min contingency (with reinforcement) and 2-min extinction (no reinforcement). Infants were categorized as performers when they moved above contingency threshold 1.5 times more often in a 2-minute-block during the contingency compared to the baseline. We compared the two groups using Welch t-test. Performers in the PT group (4/10) took longer ($M \pm SD$) 311.74 ± 62.57 s) to perform the task than the TD group (9/20; 160.24 ± 74.52 s), $p = 0.02$. Performers in the TD group generated more movements above movement threshold (normalized to baseline: 1.71 ± 0.82) compared to the PT group (1.04 ± 0.15), $p = 0.04$. No significant differences were found for leg movements between the two groups in linear ($p = 0.71$) or nonlinear variability ($p = 0.07$). Performers in the PT group took longer to perform the task and demonstrated fewer exploratory attempts during the learning process compared to performers in the TD group. Future studies are needed to explore the strategies to encourage more exploratory attempts during motor development. Funding source: NSF; SC-CTSI voucher grant.

The Impact of Object Manipulation and Multisensory Integration on Object-Label Mapping in Infants

Abigail DiMercurio, University of Tennessee, Knoxville; Daniela Corbetta, University of Tennessee, Knoxville

Studies have revealed a link between early motor and language development where gains in locomotor skills correspond to increased receptive and productive vocabulary in infants (Libertus & Violi, 2016; Oudgenoeg-Paz et al., 2016). This relationship may have been mediated by object and locomotor exploration. This study aims to examine the role of object manipulation on object-label mapping. Thirty 18-21-month-old infants were exposed to 3 novel objects each paired with a novel label. Each object was randomly presented four times with their novel label repeated three times during each presentation using carrier phrases. The timing of the object label and object manipulation varied according to 3 conditions. One condition was visual only; infants did not manipulate the objects. Two conditions allowed object manipulation but differed in their timing of label. In-Sync condition: Infants heard the label while manipulating and looking at the object. Out-of-Sync condition: Infants heard the label while viewing the object first and then manipulated the object without label presentation. Fifteen learning trials were followed by 12 test trials (4 trials per labeled object). Results show that infants who did not learn the object-label pairing in the visual-only condition demonstrated increased word learning during the In-Sync condition, when they were able to manipulate and look at the object as

they were hearing the novel label ($F(2, 79) = 12.588$, $p < .001$). Additionally, longer bouts of observed, self-produced object movements in the In-Sync condition related to better learning of the novel label ($r_s(27) = 0.415$, $p = 0.31$). The amount of movement alone was not associated with learning, which suggests that it was the confluence of auditory, visual attention, and motor activity occurring at the same time that played a role in the object-label learning pairing during these moments. These results underscore the importance of active and multisensorimotor experience in promoting the development of cognitive skills and the learning of object-label mapping in infancy.

Reaching to the Body: Is the Mouth a "Hot Spot"?

Abigail DiMercurio, University of Tennessee, Knoxville; John Connell, University of Tennessee, Knoxville; Daniela Corbetta, University of Tennessee, Knoxville

Infants spontaneously reach to their bodies from day 1, a process assumed to promote early body mapping. The mouth location is often considered a "hot-spot" endowed with particular soothing status. Indeed, fetuses and infants seem to "know" how to bring their hand to their mouth from very early on, yet, it is unclear how mouth contacts compare to touches to other body areas. Does the mouth's unique sensitive status receive more contacts? This study assessed the frequency of reaches to the mouth in relation to reaches to other body areas. The spontaneous self-touches of 5 infants were video recorded weekly from 3- to ~13-weeks-old across five, 5-min conditions (baseline, toys-in-view, sounding toys, caregiver talking, and mobile) while infants laid supine on a padded surface. Touched locations on the body were video coded across 20 areas plus the mouth area. Overall contacts made to the mouth only accounted for 3.26% of all touches. When we expanded the mouth region to the lower face, contacts to that wider area increased to 18.16%. Neither rate changed significantly over time or by condition. To gain a better representation of the rates of mouth and lower face contacts relative to other body areas, we checked their chance distributions. The probability of mouth contacts relative to lower face, whole head, or other body area contacts all occurred below chance level ($p < .005$, $p < .003$, & $p < .02$). The probability of contacts to the lower face area relative to the whole head was above chance ($p < .013$) but was below chance again when compared to contacts to other body areas ($p < .047$). These results illustrate that when mouth contacts are examined in the context of all the reaches made to the body, they actually represent only a small proportion of all the self-touches generated. Infants reach to their lower face as a whole and other areas of their body more frequently than to their mouth *per se*. These findings suggest that the mouth may not be such a hot-spot of self-touch activity and that body-mapping through touch in early infancy is a body widespread process.

A Longitudinal Study on the Development of Fitness and Motor Skills in Childhood During the Corona Pandemic

Dennis Dreiskämper, University of Münster; Lena Henning, University of Münster; Maike Tietjens, University of Münster; Nils Neuber, University of Münster; Claudia Voelcker-Rehage, University of Münster; Mara Konjer, University of Münster; Esther Pürgstaller, University of Potsdam; Stefanie Dahl, University of Münster; Tanja Jansen, University of Münster

The Corona pandemic had a considerable influence on the physical activity behavior of children. Educational and sporting facilities have been closed and the radius of movement and time spent exercising have been temporarily restricted. Sport and physical activity depend on the one hand on access, but on the other hand also on individual prerequisites such as fitness, motor skills or motivation. Longitudinal data on the effects of the pandemic on the development of motor skills and the fitness of children are hardly available. The aim of this study was therefore to investigate the effects of the Corona pandemic on the development of determinants of physical and mental health (motor skills, fitness, BMI, physical self-concept and physical activity) on a longitudinal basis. Special attention was paid to the influence of socio-demographic risk factors. A total of N = 280 students from first to fourth grade participated in motor tests (FitnessGram, TGMD-3, KTK) in March 2020 and June 2021.Data on socio-demographics were collected from 214 parents by questionnaire sampling participants based on family risk factors (e.g., educational background, income) into three groups (0, 1 or more risk factors).Structural equation modelling ($X^2 = 487.8$, $p < .01$, CFI = .99, TLI = .99, RMSEA = .04) showed high stability for BMI ($\beta = .93$) and moderate stability for fitness ($\beta = .59$). BMI and Fitness correlated negatively before ($r = -.25$) and after Lockdowns ($r = -.25$). Physical self-concept before pandemic was shown to be a significant buffer factor for fitness (ß = .23). The number of risk factors present in the family showed to be a significant predictor for fitness development ($F(2, 140) = 3.24$, $p < .05$, $h^2 = .04$; more risk factor group developed worse). Results show that vulnerable target groups are more affected by the pandemic circumstances than others. Predictors of physical activity such as fitness and moral skills, but also self-concept, should play a central role in the design of physical activity programs in childhood, especially for vulnerable target groups. Funding source: Ministry of State, State of Northrein-Westfalia, Germany.

Motor Skills Predict Daily Living and Communication Skills in Autistic Children and Adolescents

Nicholas E. Fears, University of Michigan; Stephanie A. Palmer, University of Michigan; Haylie L. Miller, University of Michigan

There is a well-documented difference between the IQ and adaptive behavior scores of children with Autism Spectrum Disorder (autism, autistic). Differences in motor skills may explain the variability in autistic individuals' adaptive behavior scores, especially in the daily living skills and communication domains. In this study, we aimed to determine how motor skills predict autistic individuals' daily living and communication skills. We tested 45 autistic children and adolescents (Male = 38, Female = 7; $M_{age} = 12.30$, $SE_{age} = 3.48$, $Range_{age} = 5.18\text{-}17.80$). We used the ADOS-2 to confirm each participant's community diagnosis of autism, and we used the MABC-2, WASI-II, and Vineland-3 to measure motor skills, IQ, and daily living skills and communication domains of adaptive behavior, respectively. We investigated whether motor skills predict the daily living skills and communication skills of autistic children and adolescents by regressing scores for each onto full-scale IQ scores, ADOS-2 scores, MABC-2 total scores, and age. Results for the analysis of daily living skills indicated that age ($F_{1,40} = 8.40$, $b = -2.00$, $SE = 0.69$, $p = .006$) and movement total scores ($F_{1,40} = 5.42$, $b = 2.40$, $SE = 1.03$, $p = .025$) were related to daily living skills. Results for the analysis of communication skills indicated that age ($F_{1,40} = 7.01$, $b = -1.41$, $SE = 0.53$, $p = .012$), ADOS-2 scores ($F_{1,40} = 5.18$, $b = 3.31$, $SE = 1.45$, $p = .028$), and movement total score ($F_{1,40} = 5.00$, $b = 1.79$, $SE = 0.80$, $p = .031$) were related to communication skills. As participants' movement total scores increased, their daily living and communication skills increased. As participants' age increased, their daily living and communication skills decreased. As participants' ADOS-2 scores increased, their communication skills increased. These findings indicate that motor skills predict autistic individuals' daily living and communication skills scores beyond the effects of age, IQ, and autism diagnostic criteria and clearly illustrate the need for understanding the effect of motor skill difficulties on autistic individuals' difficulties with adaptive behavior. Funding source: NIMH (K01-MH107774).

Sex Differences in Perceived Motor Competence After the CHAMP Intervention

Leesi George-Komi, University of Michigan; Stephanie Palmer, University of Michigan; Kara Palmer, University of Michigan; Carissa Wengrovius, University of Michigan; Katherine Q. Scott-Andrews, American University; Emily Weng, Harvard University; Leah E. Robinson, University of Michigan

Perceived motor competence (PMC), how well a child thinks they move, is an important aspect of health and can influence various health outcomes, including actual motor competence and physical activity. There is some evidence that boys may exhibit higher PMC than girls, but little is known regarding how interventions relate to these sex differences. Data support that the Children's Health Activity Motor Program (CHAMP) has immediate positive effects on children's PMC. The purpose of this preliminary analyses was to examine the sex differences of immediate post-intervention effects of CHAMP in children's PMC (total, locomotor, object control). Participants were 299 preschoolers (158 girls; M_{age}= 4.44 ± .27) from three Head Start centers in the Midwestern United States. Children either completed a 16-week (2155 minute) CHAMP intervention (n = 153) or a control condition (n = 146). Pre- and post-intervention PMC was assessed using the Digital-based Scale of Perceived Motor Skill Competence (DSPMC). Six ANOVAs were used to determine the effect of condition and sex on DSPMC scores at both timepoints. Significant main effects between DSPMC scores by sex and condition were decomposed using Bonferroni post-hoc tests. Results showed no significant main effects at pre-intervention, but at post-intervention there were significant main effects for total, $F(3, 243) = 4.32$, $p < 0.05$, and object control, $F(3,243) = 6.05$, $p < 0.001$ DSPMC scores. Post-hoc tests support that boys had higher total (CHAMP only) and object control (CHAMP and control) DPMC scores at post-intervention compared to control girls (all $p < 0.05$). There were no significant differences between CHAMP boys' and girls' PMC at either timepoints. Both CHAMP and control groups started with similar PMC, but at the end of the intervention period, girls who did not receive CHAMP had significantly lower total and object control PMC compared with boys. Further research should examine the effects of interventions on PMC development between sexes to ensure that girls are developing their PMC at rates similar to boys. Funding source: National Institutes of Health: NHLBI – 1R01HL132979.

A Qualitative Synthesis of the Relationship Between Physical Activity and Sleep in Children With Developmental Disabilities: A Systematic Review

Meghan Hancock, Auburn University; Janette Hynes, Auburn University; Melissa Pangelinan, Auburn University

Although there is substantial evidence of a positive relationship between physical activity (PA) and sleep in typically developing children and adolescents, few studies have investigated this relationship in children and adolescents with developmental disabilities. This systematic review addressed this knowledge gap. A total of 25 studies met inclusion (n = 52,736 participants). The studies included those with Autism Spectrum Disorder (8 studies), Attention Deficit Hyperactivity Disorder (6 studies), Cerebral Palsy (3 studies), Depression (3 studies), Down Syndrome (2 studies), Epilepsy (3 studies), Intellectual Disability (4 studies), Neuromuscular Disorders (2 studies), and Visual Impairment (1 study). Note: some studies included multiple disability categories. PA was quantified using parent-report questionnaires (14 studies), accelerometry (9 studies), or both (2 studies); some studies included the amount of any PA (15 studies), amount of moderate-to-vigorous PA (6 studies), or percentage of the sample that met PA recommendations (4 studies). Sleep was quantified using parent-report questionnaires (16 studies), accelerometry (7 studies), or both (2 studies). Although many sleep characteristics were reported, the most common included total sleep duration, sleep efficiency, sleep latency, and sleep disturbances. A subset of studies directly examined the relationship between PA and sleep characteristics; 14 studies reported a positive relationship, and two studies reported no relationship. The remaining 11 studies did not examine this relationship but provided quantitative data regarding average daily PA levels (any PA, MVPA) and duration of nighty sleep. Only four studies reported sleep duration of less than 8 hours. Sleep duration did not appear affected by PA levels. Taken together, there is a need to examine these relationships in those with developmental disabilities directly and the impact of PA interventions on sleep characteristics in this population using common quantitative data elements (e.g., MVPA minutes/day, sleep duration, or sleep efficiency).

What Influences Children's Physical Activity? Investigating the Effects of Physical Self-Concept, Physical Self-Guides, Self-Efficacy, and Motivation

Lena Henning, University of Münster; Dennis Dreiskämper, University of Münster; Hannah Pauly, University of Münster; Steffen Filz, University of Kiel; Maike Tietjens, University of Münster

The physical fitness self-concept is an important predictor of motivation, self-efficacy, and physical activity already in children (e.g., Stodden et al., 2008; Dreiskämper et al., 2018). Recent studies investigating predictors for physical activity in young adults reveal that the interplay of self-concept and perceptions of one's ideal (i.e., who one would ideally like to be) and ought self (i.e., who one should be from the perspectives of friends, teachers etc.), respectively, are also related to motivation and physical activity. However, the role of the ideal and ought self-perceptions for children remains an open research gap. 645 children (M_{age} = 8.87 years) filled out questionnaires twice with an interval of approximately seven months. Polynomial regression with response surface analyses and mediation analyses were conducted. Results show that the physical fitness self-concept, rather than ideal and ought self-perceptions, is associated with autonomous motivation, self-efficacy, current physical activity, and physical activity seven months later. The relationship between the physical fitness self-concept and physical activity was mediated by self-efficacy. These findings indicate that physical activity promotion programs should include physical fitness self-concept and self-efficacy enhancement in childhood.

Effects of Virtual Teaching Fundamental Motor Skills in Preschool-Aged Children

Candice Howard-Smith, Troy University; Gayle Bush, Troy University; Michele Moore, Auburn University

Due to COVID-related policies in a certain school, the face-to-face preschool perceptual-motor program (PMP) wasn't allowed during the 2020-2021 academic year. Preschool-aged children were allowed to play on the playground but didn't attend a structured PMP or physical education class where fundamental motor skills (FMS) (i.e., locomotor, object control) were taught. The present study examined effects of a virtual PMP on FMS in preschoolers. It was hypothesized that preschoolers' locomotor and object control skills would not change when participating in a virtual PMP since research supports structured active play to increase FMS development. Preschoolers (N = 24, M = 4.7 years) completed the Test of Gross Motor Development, 3rd edition (TGMD-3). Researchers were allowed in the school to conduct the TGMD-3 pretest (prior to virtual lessons) and posttest (after virtual lessons), but weren't allowed to implement a regular face-to-face PMP. Researchers pre-recorded lessons of two locomotor and object control skills for each lesson and furnished equipment to classroom teachers.

Classroom teachers provided equipment to preschoolers and showed the videos on a Smart Board. With equipment, preschoolers watched the videos and participated in the skill-related activities three times a week for 30 minutes per time for six weeks. At the end of each week, used equipment was picked up by the researchers and new, cleaned equipment was provided for the next week's lessons. Paired sample t-test results weren't statistically significant for male or female (F = locomotor, $p = .175$ and object control, $p = .213$/M = locomotor, $p = .471$ and object control, $p = .186$). Confounding factors include small sample size and lack of oversight by the researcher during the virtual lessons. Because of COVID school closures, researchers must continue to attempt to identify appropriate ways to teach FMS in a virtual setting so preschool-aged children don't fall behind in FMS development. Further research is needed to explore FMS development in preschool-aged children through virtual learning.

Can a Peer-Led Intervention Improve Fundamental Movement Skills of Grade 3 and 4 Students?

Ryan Hulteen, Louisiana State University; David Lubans, University of Newcastle; Ryan Rhodes, University of Victoria; Guy Faulkner, University of British Columbia; Yan Liu, Carleton University; Patti-Jean Naylor, University of Victoria; Nicole Nathan, Hunter New England Health; Katrina Waldhauser, University of British Columbia; Colin Wierts, University of British Columbia; Mark Beauchamp, University of British Columbia

Globally, children's proficiency in fundamental movement skills is low. Various intervention strategies have been used to improve these skills. A relatively unknown intervention modality for improving movement skills is the use of peer-led interventions. This study examined the effect of a peer-led intervention on students' movement skill outcomes (assessed at baseline and 10 weeks post-intervention assessment) using a two-arm parallel randomized controlled trial. Schools were assigned to an intervention or waitlist-control condition. The trial consisted of 6 schools, 132 grade 6 and 7 leaders (M age = 12.23 years, $SD = 0.58$), and 227 grade 3 and 4 students (M age = 9.49 years, $SD = 0.43$). Grade 6 and 7 students first received 4 x 40-minute lessons on leadership and 3 x 40-minute lessons of experiential education focused on the delivery of movement skill sessions. After training was completed, the 10-week peer-led intervention with grade 3 and 4 students began. During this 10-week period, Grade 6 and 7 students taught a class of grade 3 and 4 students twice a week for 30 minutes (total intervention dose = 600 minutes). Movement skill outcomes included: maximal throwing speed and kicking speed (assessed by radar gun), throwing and kicking competency (assessed by Test of Gross Motor Development-3) and number of successful catches (assessed by a novel throwing-catching combination protocol). There were no significant intervention effects for maximum throwing speed ($b = 0.449$, $p = 0.128$), maximum kicking speed ($b = 0.516$, $p = 0.440$), throwing ($b = 0.054$, $p = 0.839$) and kicking ($b = -0.733$, $p = 0.099$) competency, nor catches ($b = 0.068$, $p = 0.870$), while controlling for baseline and sex. The efficacy of the peer-led intervention for improving fundamental movement skills of grade 3 and 4 students was not supported in this trial. These results contrast with the initial pilot study and suggest that implementation challenges and/or changes in delivery mode and age group from the initial pilot study may be the reason. Funding source: Social Sciences and Humanities Research Council.

Additional Skills and Training are Needed to Increase Inclusion of Individuals With ASD in CrossFit

Janette Hynes, Auburn University; Melissa Pangelinan, Auburn University

The Adaptive Training Academy created an adaptive and inclusive trainer (AIT) certification to enhance the knowledge and skills to conduct functional fitness training (e.g., CrossFit) with people with disabilities. There are currently over 3,100 AITs that primarily work at one of the 84,000 CrossFit affiliates worldwide. However, the present certification does not include modules specific for working with individuals with autism spectrum disorder (ASD). The purpose of this study was to determine the number of AITs and CrossFit affiliates that currently work with individuals with ASD, identify barriers to participation for individuals with ASD, and instructor knowledge of ASD. A survey was completed by 71 AITS and 19 CrossFit affiliate owners; 48% work with athletes with ASD. The reasons for not working with individuals with ASD included the belief that there was a "lack of athletes with ASD interested in participating" (42%), "lack of knowledge to coach athletes with ASD" (21%), "lack of space for classes specific to those with ASD" (12%), and "lack of finances to support athletes with ASD" (17%). Additional reasons reported were limited parental education regarding health and wellness, poor buy-in from schools, and an assumption that the gym environment is inappropriate for those with ASD. The participants also rated their knowledge of ASD from 1 (strongly disagree) to 5 (strongly agree). The scores suggest a modest understanding of ASD: "I understand the characteristics of ASD" ($M = 4.02$), "I understand the movement and physical health problems common in ASD" ($M = 3.72$), and "I have the knowledge and skills to work with athletes with ASD" ($M = 3.71$). Over half of the respondents (59%) indicated they would like to develop knowledge and skills to work with individuals with ASD and 64% indicated they were interested in working with individuals with ASD. These preliminary results suggest a need to elaborate the current AIT curriculum and provide instructors with resources to facilitate safe participation and greater inclusion of individuals with ASD in CrossFit.

Examining the Moderating Effect of Age on Relationships Between Motor Engagement Factors in Children

Patricia Lasutschinkow, Eastern Michigan University; Jin Bo, Eastern Michigan University

Research on motor engagement in children shows synergistic relationships between four factors: actual and perceived motor competence (MC; PMC), physical activity (PA) and physical fitness (PF). While models theorize these relationships strengthen with development, few studies have examined the impact of age on these relationships. This study examined the moderating effect of age on relationships between these factors. It was hypothesized that as age increased, relationships between factors would strengthen. Children ($N = 61$, $M_{age} = 10.75 \pm 6.25$ yrs) and caregivers completed measures of MC (Developmental Coordination Disorder Questionnaire), PMC (Richards Physical Self Concept Scale), PA (Physical Activity Questionnaire), and PF (FitnessGram, BMI). Moderation analyses were conducted with age as moderator, PF as the independent variable, and PMC, PA, or MC as outcomes. The addition of age in a model of PF (BMI) and PMC resulted in significant change in the model's explanatory power ($\Delta R^2 = .049$, $p < .001$); older children had significant relationships between PF and PMC ($b = 0.61$, $SE = 0.26$, $p = .02$) but younger children did not. In a model with PF (FitnessGram) and PMC, including age resulted in significant change ($\Delta R^2 = .099$, $p = .005$); older children had significant relationships between the factors ($b = 0.70$, $SE = 0.20$, $p < .001$). A similar pattern was found between PF (BMI) and MC ($\Delta R^2 = .090$, $p = .019$), suggesting the effect was significant in older children ($b = 4.43$, $SE = 1.96$, $p = .028$). The addition of age in a model of PF and PA showed significant interaction ($\Delta R^2 = .082$, $p = .023$); older children had significant relationships between PF and PA. These results suggest that relationships among PA, MC, PMC, and PF were strengthened with development for older children, which is consistent with models of motor engagement. For younger children, such relationships were not clear and negative correlations between PA and PF were surprising. More research is needed to

explore these findings, particularly in relation to interventions aiming to increase motor engagement.

Motor Competence and Socialization Skills in Children With Autism Spectrum Disorder

Ting Liu, Texas State University; Michelle Hamilton, Texas State University; Abhisha Patel, Texas State University

Motor competence and social interaction play an important role during childhood. Children diagnosed with autism spectrum disorder (ASD) have shown to have poor motor competence and social functioning. It is important to evaluate how these skills can influence the capabilities of the children with ASD to that of the normative means. The purpose of this study was to examine the motor skills competence and socialization skills in children with ASD in comparison to the normative data. Twenty-seven children diagnosed with ASD participated in this study with the age range from 6 to 15 years (10.19±2.6 years). Movement Assessment Battery for Children-Second Edition (MABC-2) was used to evaluate the children's motor competence and the Autism Social Skills Profile-2 (ASSP-2) survey was given to the parents or primary caregivers to evaluate the children's socialization skills. The descriptive analysis showed that 85% of the children with ASD were classified under the red and amber zones indicating motor delays or at risk for developing movement difficulties. The single-sample t-test revealed a significant delay in motor competence in manual dexterity (MD), aiming and catching (A&C), and balance (BAL) among the children with ASD when compared to the norms. In addition, 66.6% of the children with ASD were at or below the 50th percentile indicating that they had poor social skill functioning. However, the single sample t-test did not show statistical significance between the socialization skills of the children with ASD and the norms. These findings suggest that focusing on creating intervention programs including elements for both motor competence and socialization skills would allow for the most benefit in the children with ASD.

How Are Infants Active in Daycare?

Yuemei Lu, Michigan State University; Ashley Mcpeek, Michigan State University; Darice Brooks, Michigan State University; Janet Hauck, Michigan State University

Infants spend much of their waking hours in the daycare setting, rather than at home. Thus, daycare centers are an ideal setting to influence and promote physical activity and motor development. The purpose of this cross-sectional study was to gain an understanding of how and in what positions infants are active in daycare. Researchers did one-time observations individually on 14 typically developing infants ($M_{age} = 9.13 \pm 2.70$ months) across four center-based daycares. Measures included ankle-worn accelerometry and observation of the amount of time infants spend in common positions [infant positioning devices (IPD), prone, supine, kneeling, sitting, standing, creeping] and activities [IPD play, non-IPD play, sleeping, adult-handled], recorded to the nearest second. Accelerometer data is presented as average 1-sec vector magnitude and percentage of time spent in quartiles of activity. Data were analyzed using descriptive statistics. For time spent in common positions, infants spent most of their awake time (56%) in a sitting position, followed by supine (13%), prone position (10%), standing (10%), IPDs (5%), creeping (5%) and kneeling (1%). For time spent in common activities, infants spent 52% of the time in non-IPD play, 14% in IPD play, 17% in adult handling, and 16% sleeping. To summarize the average level of activity, infants spent the majority (33-92%) of their observed time in the 25th percentile of movement (lowest quartile of activity). Infants had the highest average vector magnitude in non-IPD play (46.49 ± 66.78). This was followed by adult handling (36.12 ± 55.05), IPD play (24.80 ± 47.63) and sleep (2.67 ± 18.71). Despite spending most of the time in a sitting position, it produced the lowest vector magnitude (8.86 ± 47.83), followed by IPD (18.44 ± 40.20), prone (34.53 ± 54.70), kneeling (48.42 ± 66.07), supine (50.46 ± 68.59), standing (50.97 ± 66.65) and creeping (51.42 ± 71.85). These findings suggest promotion of floor play without the use of IPDs and scaffolding in order to advance motors skills such as creeping, kneeling, and standing.

To Use or Not to Use: Are All Motor Tests the Same?

Carlos Luz, Instituto Politécnico de Lisboa & Escola Superior de Educação de Lisboa; Luis P. Rodrigues, Instituto Politécnico de Viana do Castelo; André Pombo, Universidade de Lisboa & Instituto Politécnico de Lisboa; Rita Cordovil, Universidade de Lisboa

Motor competence (MC) is presented as a key variable for the development of human movement, physical activity, sports participation, and an active lifestyle. Unfortunately, the current motor opportunities offered and experienced by children display clear differences between genders, and boys are usually more proficient than girls. Additionally, there are more and more MC studies using different instruments and tests to assess MC. But are all motor tests equally effective when the goal is to discriminate motor performances? The objective of this study is to understand whether some motor tests can be used to discriminate different levels of motor proficiency in each sex.One hundred and twenty-six boys ($M = 10.88$; $SD = 2.26$) and one hundred and twenty-one girls ($M = 11.17$; $SD = 2.36$) were evaluated using the Motor Competence Assessment (MCA) and subsequently separated in two motor level groups (high and low motor competence) by sex. The MCA is a well-established instrument used to assess motor competence along the lifespan. Additionally, all participants were evaluated in 5 more motor tests, namely: wall toss test, hopping on one leg over an obstacle, walking backwards on balance beams, kicking precision and throwing precision. Anovas 2×2 (sex x proficiency groups) were performed in order to understand the differences between the motor proficiency groups by sex in each of the 5 motor tests. The results seem to indicate that in boys, the group with higher motor proficiency always presents statistically superior results compared to their peers with lower motor proficiency in all motor tests (all $p < 0.01$). However, this is not true for girls where there are no statistically significant differences between groups of motor proficiency in any of the motor tests. The results highlight that some caution is needed when selecting motor tests particularly for girls, because some of them present little discriminatory power between different groups of motor proficiency in girls, which may affect the results of the investigations. Funding source: PI&CA/2021/MCA_PND & IPL/2021/MCA_VAL_ESELx.

Children's Physical Activity During the COVID-19 Lockdown: A Cross Cultural Comparison Between Portugal, Brazil and Italy

Carlos Luz, Instituto Politécnico de Lisboa & Escola Superior de Educação de Lisboa; André Pombo, Instituto Politécnico de Lisboa; Luis Paulo Rodrigues, Instituto Politécnico de Viana do Castelo; Cristina Sá, Universidade Federal de São Paulo; Cristhina Siegle, Universidade Federal de São Paulo; Patrizia Tortella, Free University of Bolzano; Guido Fumagalli, University of Verona; Rita Cordovil, Universidade de Lisboa

COVID-19 pandemic forced governments to implement measures of lockdown, to control virus transmission, which disrupted the daily routines of many families worldwide. This study aimed to determine how lockdown affected children's routines in Portugal (PT), Brazil (BR) and Italy (IT), more specifically if children's age and country affected their physical activity (PA) and sedentary time during lockdown. An anonymous online survey was launched to assess how children between 3 and 12 years of age adjusted their daily routines to this situation. Parents reported the time each

child was engaged in different activities throughout the day, which was used to calculate overall sedentary time and overall physical activity time. Separate ANOVAs were performed to investigate how age and country affected the percentage of time spent in the different activities. Results based on the data from 3045 children (PT $n = 2044$; BR $n = 836$; IT $n = 165$) showed that during lockdown most children spent most part of awaken daily hours in sedentary activities, but there was a clear age effect on the way children's routines were organized. Time spent in intellectual activity, playful screen, and overall sedentary time was bigger in the older age groups, whereas the time spent in play (with and without PA) and in overall PA was greater in the younger groups. A main effect of country was found for all variables except play without PA. The country effect was mainly due to the difference between the routines in BR when compared to PT and IT. Values of playful screen time and overall sedentary activity were higher in BR than in the two European countries. Conversely, values for play with PA, PA and overall PA (except in the older group) were lower in BR. IT and PT displayed similar patterns, but in the PA and overall PA categories, IT presented higher values than PT in the two younger age groups. In summary, PA of confined children showed low levels and a decreasing trend along childhood in the three countries. Brazilian children spent less time in overall PA than their European peers. Funding source: PI&CA/2021/MCA_PND & IPL/2021/MCA_VAL_ESELx.

Factors that Predict Learning of Gross Motor Skills in Preschoolers Participating in a Universally Designed Intervention

Sally Miedema, University of South Carolina; Chandler Casner, University of South Carolina; Alexandra Stribing, University of South Carolina; Stephen Griffin, University of South Carolina; Layne Case, University of South Carolina

Implementing school-based interventions is an effective practice to address the secular decline in young children's gross motor skills. Universal design for learning (UDL) is a framework purported to include within group factors at the start of the intervention. However, more research is needed to explore differential effects of demographics in UDL interventions. The purpose of this study was to explore which factors predicted change in motor skills in children after receiving a UDL intervention. Participants included 3–6-year-old children ($N = 273$; girls = 129; boys = 144; Caucasian = 177; Black = 40; Hispanic = 47; Other = 9) randomly assigned to either control ($n = 131$) or intervention ($n = 142$) groups. Children were pretested and posttested on the Test of Gross Motor Development-3 (TGMD-3). The intervention group completed at least 1,000-minutes of motor skill intervention over the course of nine months. Descriptive analyses revealed a positively skewed distribution at pretest regardless of grouping, age, sex, and ethnicity. By the posttest, the distribution shifted from a positive skew to bimodal; the experimental group was negatively skewed while the control group remained positively skewed regardless of demographics. Results of two separate linear regressions confirmed that group was the only significant predictor for change in both object control and locomotor skills ($\beta = .357$-$.448$; $p < .001$; $R^2 = .136 - .201$, $p < .001$). As intervention effects did not vary based upon sex, age, or ethnicity, a universal design can support learning for all children within one program. Funding source: NIH – P20GM130420.

Autistic Twitter Users' Experiences With Motor Problems and Co-Occurring DCD

Haylie L. Miller, University of Michigan; Gavin D. Lichtenberg, University of Michigan; Riya Chatterjee, University of Michigan; Nicholas E. Fears, University of Michigan; Priscila M. Tamplain, University of Texas-Arlington

Little is known about the co-occurrence of autism and Developmental Coordination Disorder (DCD). There is a critical need for community-informed research on this topic, particularly in the adult population where motor problems in autism are not well-characterized. Social media affords an international opportunity for autistic adults with and without a co-occurring DCD diagnosis to share their experiences with motor problems. In doing so, they provide valuable insight into the lifespan impact of motor problems on functional ability, participation, compensatory strategies, and well-being. We used the Twitter research API to collect tweets ($n = 294{,}388$) containing terms related to autism (e.g., ASD, autistic, aspie) and DCD (e.g., DCD, dyspraxic, dyspraxia) from a 6-month span. We identified 5,503 users who self-identified with terms related to autism, 78 users with terms related to DCD, and 51 users with both in their profile descriptions. This indicates that approximately 1% of autistic individuals on Twitter identify as having DCD. To further examine the relationship between autism and motor problems, we analyzed tweets ($n = 171$) about motor problems from 31 autistic users (2 with co-occurring DCD) during AutChat, a weekly autistic Twitter discussion forum. Using grounded theory, we started from a list of a priori terms related to motor skills and problems (e.g., balance, walking, clumsy, uncoordinated) and reviewed a subset of tweets to identify additional related terms for inclusion in the final search. We then reviewed tweet contents to extract themes, assess the frequency with which certain problems were discussed (e.g., driving, dressing, working, walking), and differentiate childhood from adulthood experiences. Results are discussed in the context of the lifespan impact of motor problems on activities of daily living, and with respect to the presence or absence of a DCD diagnosis. This new knowledge serves as a starting point for understanding the domains of life affected by motor problems across development in autism. Funding source: NIMH (K01-MH107774).

Comparing Variations of Skill Performance From Product-Oriented Measures of Fundamental Motor Skills

Kara K Palmer, University of Michigan; Michael A Nunu, University of Michigan; Adam Pennell, Pepperdine University; Bryan Terlizzi, University of South Carolina; David F. Stodden, University of South Carolina; Leah E Robinson, University of Michigan

The purpose of this study was twofold, to (1) consider how different variations of performance from product-oriented assessments relate to each other (e.g., maximum, average of 3 or 5 trials) and (2) examine how different variations of performance relate across time. This study included 299 children (158 girls; M age = 4.44 ± .27) from three Head Start Centers within the United States. Children completed a battery of product-oriented assessments of six motor skills- throwing (m/s, 5 trials), kicking (m/s, 5 trials), catching (yes/no, 5 trials), jumping (cm, 5 trials), running (m/s, 2 trials), and hopping (m/s, 4 trials- 2 preferred foot, 2 non-preferred foot). A total of 35 variations of skill performance were derived – throw ($n = 7$), kick ($n = 7$), catch ($n = 2$), jump ($n = 7$), run ($n = 3$), hop ($n = 9$). Children completed the battery every 6-months starting at the beginning of preschool until first grade. The relationship among assessment variations were determined using Pearson's correlations. Linear-mixed models were fit to determine if variations in how skill performance was assessed changed across early childhood. There were strong correlations among all variations of how skill performance was assessed for the throw (r_{range}= 0.98-0.80), kick (r_{range}= 0.97-0.77), and jump (r_{range}= 0.99-0.86). There were large ranges in correlations for the run (r_{range}= 0.94-0.25) and hop (r_{range}= 0.96-0.29). Linear mixed models revealed that children's motor performance improved over time for two variations of the throw, one variation of the catch, five variations of the jump, and three variations of the hop (all, $p < 0.05$). These results support that some variations of product-oriented assessments (e.g., maximum, average of 3 or 5 trials) highly relate whereas others do not. These differences may be attributable to several factors but suggest that young children demonstrate inter-trial variability when

completing motor skill assessments. Researchers should be aware of these differences and inter-trial variability when selecting and interpreting findings from variations of skill performance. Funding source: This work was supported by the National Institutes of Health under Grant NHLBI-1R01HL132979.

Examining the Intersectionality of Product- and Process-Oriented Approaches to Measuring Motor Skills Across Early Childhood

Kara K Palmer, University of Michigan; Adam Pennell, Pepperdine University; Bryan Terlizze, University of South Carolina; Michael A Nunu, University of Michigan; David F Stodden, University of South Carolina; Leah E Robinson, University of Michigan

Process- and product-oriented approaches to measuring motor skills yield related yet distinct information about motor performance at a single time point, but there is a limited understanding of how different orientations to motor skill measures relate across time. The purpose of this study was to examine the relationship between process- and product-oriented motor skill measures across early childhood. This study included 299 children (158 girls; M age = 4.44 ± .27) from three Head Start Centers within the United States. Children completed the Test of Gross Motor Development-3 (TGMD-3; Ulrich, 2019) and a battery of product-oriented assessments of six motor skills- throwing (m/s), kicking (m/s), catching (yes/no), jumping (cm), running (m/s), and hopping (m/s). Children completed motor skill assessments every 6-months starting at the beginning of preschool until first grade. Linear mixed models with random intercepts were fit to investigate the relationship between process- and product-oriented assessments across time. Models were fit with a predictor of process-oriented measures adjusting for age, sex, treatment, height, weight. Controlling for all other parameters in the model, there were significant interactions whereby children's scores on the TGMD-3 predicted product throwing, catching, jump, and hopping (all $p < 0.05$). There was a change from an inverse to a positive relationship between process- and product- throw and catch, but always a positive relationship between process- and product- jump and hopping. We draw three primary conclusions from these data. First, there appear to be different aspects of motor competence assessed from process- and product-oriented measures for the run and kick. Secondly, children's execution (process) of the throw, catch, jump, and hop partially explains variation in the outcome of the movement (product). Lastly, it appears children might sacrifice the outcome of movement for better execution with future improvements in outcomes gained from better execution for the throw and catch. Funding source: This work was supported by the National Institutes of Health under Grant NHLBI-1R01HL132979.

Improved Locomotor Skills Following CHAMP Predict Higher Moderate-to-Vigorous Physical Activity Levels in Preschoolers

Stephanie A. Palmer, University of Michigan; Leesi George-Komi, University of Michigan; Kara K. Palmer, University of Michigan; Katie Q. Scott-Andrews, American University; Emily Meng, Harvard University; Carissa Wengrovious, University of Michigan; Leah E. Robinson, University of Michigan

Fundamental motor skills (FMS) are associated with children's ability to engage in health-enhancing physical activity (PA). Motor skill interventions, such as the Children's Health Activity Motor Program (CHAMP), improve children's FMS. However, there is limited understanding of whether skill changes in CHAMP are associated with changes in children's PA post-intervention. The purpose of this study was to examine if changes in FMS (locomotor, ball skills, total) predict changes in moderate-to-vigorous PA (MVPA) engagement following CHAMP. Children (N = 153, 86 girls, M age = 53.14 months) from three Head Start centers participated in this study. FMS and PA measures were taken pre- and post-CHAMP intervention. FMS were assessed using the Test of Gross Motor Development 3rd Edition (TGMD-3; Ulrich, 2019), and locomotor, ball skill, and total raw scores were retained for analysis. Children's PA was measured by a waist worn Actigraph accelerometers for one week. Valid wear time was defined as at least 4-days (including one weekend day) and at least 9-hours/day. Paired t-test were used to examine pre-post differences, and linear regression models were fit to examine the association between skill changes and change in MVPA. Children's locomotor (M_{diff} = 7.99, t = 15.92, $p < .01$), ball skills (M_{diff}= 8.85, t = 17.17, $p < .01$), total skills (M_{diff} = 16.79, t = 20.79, $p < .01$), and MVPA engagement (M_{diff} = 9.22, t = 4.92, $p < .01$) significantly improved post-CHAMP. Controlling for sex, pre-test MVPA and T1 LM skills, T2 LM locomotor skills significantly predicted posttest MVPA (b = 1.03, $p < .01$). These findings suggest that locomotor skill gains elicited through the CHAMP program support positive children's MVPA at the end of the intervention. Further, our results align with current theoretical models on the role of FMS in supporting children's PA. Funding source: NHLBI- 1R01HL132979.

Effect of Age on the Kinematic Characteristics of Commonly Observed Manual Exploratory Behaviors in Preschoolers

Priya Patel, Michigan State University; Harsh Pandya, Toyota Research Institute; Mei-Hua Lee, Michigan State University

Manual exploratory behaviors comprise of a variety of different behaviors that play important functional and clinical role during early childhood. Rotation and throwing are two such important manual exploratory behaviors that- (1) functionally contribute to learning of perception of object properties and (2) clinically show atypical expressions in developmental disorders such as Autism. While these behaviors are often studied qualitatively using frequency and duration of their occurrence, their quantitative movement characterization (velocity profile, smoothness, etc.) is needed to fully understand their role during early childhood. In this study we aimed to characterize the kinematics of rotation and throwing behaviors in early childhood; thereby assess an effect of age on their kinematic characteristics. In a home-based remote study, we assessed rotation and throwing behaviors in 30 preschoolers (3–5 years) while they explored 5 different objects. Data was collected by recording the video call and using wireless sensors embedded in the exploratory objects. We characterized rotational movements using angular jerk, angular velocity profiles and amount of exploration along axes of rotation, and throwing movements using linear jerk and acceleration profiles. Our preliminary findings indicate an effect of age on rotational behaviors- 3-year-olds had higher angular jerk while 5-year-olds showed higher variability in the exploration along different axes. No differences were found in the kinematics of throwing behaviors across ages. These kinematic characteristics quantified subtle movement differences in rotation and throwing behaviors that are not distinguishable on visual assessment. Such movement characterization holds strong potential to quantify the nature and degree of atypical expressions in these behaviors, which are critical for early assessment of neurodevelopmental disorders.

Differential Association Between Distinct Domains of Cognitive Function and Postural Control in Early-Adolescent Boys

Adam Pennell, Pepperdine University; Michael Duncan, Coventry University; Mathew Hill, Coventry University

Evidence suggests that motoric (e.g., postural control) and cognitive (e.g., executive function) outcomes have a dynamic, reciprocating influence on one another across the lifespan. The magnitude of a particular

motor-cognitive interaction likely varies across populations, tasks, and environments (i.e., differential results). This study investigated bivariate associations between various single-task cognitive and postural control parameters in early-adolescent boys. Eighteen participants (M_{age} = 9.8 ± 1.9 years) completed a 30-second quiet standing task (center of pressure values: anteroposterior and mediolateral amplitudes, mean velocity), the Y-Balance test (right and left foot composite scores), the Deary-Liewald simple and choice reaction time tasks, the two-part Trail Making Test, the three-component Victoria Stroop test, as well as the forward and backward Corsi block-tapping test. Pearson product moment coefficients were calculated to investigate for associations between postural and cognitive outcomes. Significant positive correlations were observed between simple and choice reaction time with quiet standing center of pressure values (r = .56 – .82, p < .05 to .001). Mean velocity (r = .49 – .60, p < .05 to .01) as well as the left (r = .57 – .63, p < .05 to .01) and right (r = .64 – .72, p < .01 to .001) foot composite Y-Balance scores significantly correlated with all three Victoria Stoop test values. Results also revealed significant inverse associations between the forward Corsi block-tapping test and the Y-Balance test (left foot: r = -.48, right foot: r = -.48, both p < .05). Postural control values had moderate-to-strong associations with particular cognitive metrics. When statistical significance was found, postural control scores explained 23 (right foot Y-balance composite score and the forward Corsi block-tapping test) to 68% (mean velocity and simple reaction time) of the variance within a given cognitive assessment. Implications and hypothesized explanations for these results will be provided.

Physical Activity and Functional Body Image in Youth With and Without Visual Impairments

Melanie Perreault, State University of New York at Brockport; Katriana Belknap, State University of New York at Brockport; Pamela Beach, State University of New York at Brockport; Lauren Lieberman, State University of New York at Brockport

Poor body image has been linked to many adverse psychological issues. Recent research suggests there is a positive relationship between functional body image, a more objective evaluation of what the body can do, and physical activity (PA) in typically developing youth. However, functional body image has not been studied in youth with visual impairments (VI) who often have lower body image and participate in less PA than their sighted peers. Therefore, the purpose of this study was twofold: (1) determine differences in functional body image between youth with and without VI and (2) examine the relationship between functional body image and PA in youth with VI. Participants were 20 youth with VI (*M* age = 11.7 years, *SD* = 3.4) and 20 youth without disabilities (*M* age = 10.3 years, *SD* = 2.6). All participants completed the Embodied Image Scale and Organized Sport (OR) and Active Physical Recreation (AR) activity categories of the Children's Assessment of Participation and Enjoyment, which measures five dimensions of activity participation: diversity, intensity, with whom, where, and enjoyment. The results indicated that participants with VI had significantly lower functional satisfaction (p = .006) and marginally lower functional investment (p = .059) compared to participants without disabilities. Results also revealed several positive relationships between functional body image and PA for the participants with VI: functional values with AR where (r = .472), functional satisfaction with AR intensity (r = .459) and AR enjoyment (r = .501), and functional investment with AR (r = .554) and OS enjoyment (r = .655). Interestingly, we found significant negative relationships between functional investment and AR diversity (r = -.475) and intensity (r = -.501). These findings suggest that youth with VI are overall less satisfied and invest less in their functional body image compared to sighted peers; however, increased enjoyment in PA may help mitigate these differences. Future research should examine if PA interventions can increase functional body image in this population.

Quantifying Fetal Movements Using MRI: Distinguishing Right From Left Limb Movements

Eryn Perry, University of Southern California; Nushka Remec, University of Southern California; Judy Zhou, University of Southern California; Jessica Wisnowski, University of Southern California; Vidya Rajagopalan, University of Southern California; Beth A. Smith, University of Southern California

Video coding of infant movement is an established practice used to quantify different types of movement patterns and to describe differences in developmental trajectories. Fetal motion is used as a screening tool for fetal health. As of yet there are no systematic studies on the emergence of fetal motor activities. By adapting existing MRI sequences to fetal imaging, our group was able to create short "videos" of fetal movement, offering the potential to quantify fetal movement patterns using video coding. The purpose of this abstract is to describe fetal limb movements, particularly how often we can distinguish right from left limb movements. As part of an ongoing MRI study of typically developing fetuses, fetal movement was captured for 10 fetuses using Cine MR data. Length of analyzed fetal MRI videos ranged from 48.2s to 81.9s. Gestational ages of the fetuses ranged from 22 to 38 weeks. One researcher coded the videos in ELAN 6.2. First, body segments were identified: head, jaw, trunk, right/left (R/L) arm, R/L foot, or unknown. Each body segment was labelled as Not Visible, Visible (but not moving), or Moving across the duration of the video. We calculated mean, standard deviation, median, and range for the total movement time across videos and counted the visible limb segments. In 9 out of 10 videos, the fetuses displayed movement. Total time spent moving averaged 15.7 sec per video (*SD* = 10.5s) with a median of 14.2 sec and total durations ranging from 0 sec to 29.8 sec. All four limbs could be distinguished in 5 videos; each of these videos contained movement. Three videos contained at least one unknown arm or leg, or at least one unidentified segment. R/L arms and R/L legs could be distinguished in 9 and 8 videos, respectively. Overall, R/L limbs could be distinguished in a majority of the videos, particularly when fetal movement was present. Our findings show evidence that fetal MRI sequences can be used as a video source for studying fetal motor activity in utero. This opens an exciting possibility for early identification of atypical motor development.

Trajectories of Physical Activity of Children on the Autism Spectrum and Their Caregivers: Outcomes of a Virtual 12-Month Longitudinal Health Program

E. Andrew Pitchford, Iowa State University; Franziska Loetzner, Wayne State University; Leah Ketcheson, Wayne State University

Participation in health enhancing physical activity (PA) is a critical component of overall well-being for children and adults. However, opportunities to engage in extracurricular PA opportunities for families with a child on the autism spectrum are relatively limited. The global pandemic has further complicated accessibility and isolated vulnerable populations. A virtual health promotion program has the potential to address many participation barriers and represents a timely opportunity to safely promote PA and health trajectories. Families of children on the autism spectrum in Detroit, MI were recruited to participate in a 12-month virtual health program. The focus was to promote PA among the child-caregiver dyad. The program included weekly PA activities, via Zoom, specifically designed to promote physical literacy for children on the autism spectrum and physical fitness for adult caregivers, respectively. PA of the dyad was measured at baseline and again at 4-, 8-, and 12-month

follow-ups with a caregiver reported survey. The final sample included 29 families, including children on the autism spectrum (76% male, 8.36 ± 3.68 years) and caregivers (97% female, 40.55 ± 8.54 years). Family participation in the virtual PA sessions each week was lower than expected with attendance of approximately 60%. However, Friedman test results indicated that reported PA levels increased significantly for both children ($\chi^2 = 14.92$, p=.002) and caregivers ($\chi^2 = 14.26$, p=.002) over the 12-month intervention. Post-hoc Wilcoxon Signed Ranks tests identified the largest gains in reported PA came between baseline and 8-months for children ($p = .008$) and between baseline and 12-months for caregivers ($p = .001$). Despite improvements in both groups, the rank correlation between PA of children and caregivers was low across the intervention (r_s = .27-.34; $p > .05$). The virtual PA program was effective for both children on the autism spectrum and caregivers to significantly increased reported PA levels, but improvements can be made to improve program adherence. Funding: Michigan Health Endowment Fund Funding source: Michigan Health Endowment Fund.

Associations Between Fundamental Motor Skills and Balance in Elementary School-Aged Children: A Pilot Study

E. Andrew Pitchford, Iowa State University

Fundamental motor skills (FMS) are considered the "building blocks" of more complex movements needed to engage in physical activity. However, there is debate as to whether balance should be operationalized as a FMS or as an underlying or perquisite ability. Balance, better defined as postural stability, is the ability to maintain center of gravity within a given base of support. However, much of the balance research in this field has relied on field tests of single-legged stance time. As a starting point to understand better the relationship between balance and FMS, more advanced measurement of postural stability is needed. The purpose of this pilot study was to examine associations between postural sway and FMS from the Test of Gross Motor Development, 3rd edition (TGMD-3). Twenty-seven children, ages 5-10, participated in the pilot study. Children were assessed on FMS competency with the TGMD-3 and postural sway with the BTrackS balance board and software. Postural sway was measured as the 95% confidence interval ellipse area (cm^2) during a 20-second trial. Raw ball skill scores had a significant negative relationship with sway area ($r = -.57$, $p = .002$). The association was stronger for mediolateral sway ($r = -.50$, $p = .007$) than for anteroposterior sway ($r = -.32$, $p = .099$). Locomotor skill scores were not significantly associated with postural sway ($p > .05$), which contrary to previous findings. Relationships were further examined with specific TGMD-3 skills. Significant associations with sway area were observed for the gallop ($r = -.43$, $p = .024$), two-hand strike ($r = -.55$, $p = .003$), one-hand strike ($r = -.42$, $p = .027$), catch ($r = -.49$, $p = .009$), overhand throw ($r = -.59$, $p = .001$), and underhand throw ($r = -.47$, $p = .014$). Higher TGMD-3 scores were associated with less postural sway. The study provides preliminary evidence that ball skills may be related to postural stability, especially mediolateral sway. More research is needed to determine if balance is necessary for proficient motor skills in elementary school-aged children. Funding source: Healthy Weight Research Network.

Is Motor Competence a Key Factor in Children's Body Composition, Independent of the Method Used for Measuring It?

André Pombo, Instituto Politécnico de Lisboa; Luis Paulo Rodrigues, Instituto Politécnico de Viana do Castelo; Ana Catarina Moreira, Instituto Politécnico de Lisboa; Rute Borrego, Instituto Politécnico de Lisboa; Margarida Machado, Instituto Politécnico de Lisboa; Vânia Costa, Instituto Politécnico de Lisboa; Ana Almeida, Instituto Politécnico de Lisboa; Ana Sofia Tavares, Instituto Politécnico de Lisboa; Cristina Sá, Universidade Federal de São Paulo; Carlos Luz, Instituto Politécnico de Lisboa & Escola Superior de Educação de Lisboa

The increase of sedentary behaviors and a decrease in children physical activity (PA) observed in the last decades led to an increase of the prevalence of overweight and obesity in children worldwide. Most of the investigation on this field focus on components of physical fitness (PF) (cardiovascular fitness and upper body strength), however Motor Competence (MC) has been associated with childhood obesity in several studies. An adequate level of MC is prerequisite for PF and its development can impact lifelong PA habits therefore it's important to understand how these variables behave in different measures of body composition (BC). The aim of this study is to understand if the association of MC and childhood obesity is similar in different measures of BC (Body mass index (BMI), Skinfold and Fat mass in kg) and to determine the role of the different motor skills components (MC, cardiovascular fitness and upper body strength) in this relationship. 181 children with a mean age of 7,93 years ($SD = 1.28$) were evaluated in MC (MCA instrument), cardiovascular fitness (PACER test), upper body strength (handgrip), BMI, skinfold thickness (Slaughter equation) and fat mass weight (value obtained in the slaughter equation converted in kg). Pearson correlations were used to understand the associations between MC and the BC variables, also separate multiple standard regressions were performed to explore the effect of motor skills components in the different measures of BC. MC, cardiovascular fitness and upper body strength were used as independent variables (predictors) and BMI, skinfold thickness and fat mass weight as dependent variable. Overall, the results showed that MC is weak to moderate associated with childhood obesity independently of the measure used for BC (range between -.285 and -.316, $p < .01$). Furthermore, only upper body strength and MC were significant predictors ($p < .001$), discarding cardiovascular fitness, independently of the method used for BC. Our results indicate that MC seems to have a similar behavior, in different methods that evaluate BC. Funding source: PI&CA/2021/MCA_PND & IPL/2021/MCA_VAL_ESELx.

The Use of MRI for Fetal Movement Analysis: An Exploratory Study

Nushka Remec, University of Southern California; Eryn Perry, University of Southern California; Judy Zhou, University of Southern California; Jessica Wisnowski, University of Southern California; Vidya Rajagopalan, University of Southern California; Beth Smith, University of Southern California

Advanced imaging techniques provide a new opportunity to assess fetal motor behavior. Previous studies have documented the successful capture of mid-gestation fetal movement using Cine MR imaging techniques, however a standardized movement criterion has not yet been validated. Our purpose was to quantify the visibility and movement of body segments in a pilot sample of fetal Cine MRI's. Ten datasets were randomly selected from an ongoing study of typically developing fetuses. Fetal gestational age at MRI ranged from 22 weeks to 38 weeks. Duration of sequence and frame rate varied from 50 sec (5 frames/sec; 1 dataset) to 1:23 (3 frames/sec; 9 datasets). ELAN was used for dataset annotation with one researcher identifying segments of head, jaw, trunk, arms, and legs. In order to be coded as visible, segments had to clearly represent their respective anatomy. Unidentifiable segments were labeled as such. A segment was coded as moving (any portion of the segment), or not moving. Excel/MatLab were used for analyses. The percentage of time segments were visible were as follows: jaw 100%, head/trunk 99%, upper extremity 70%, and lower extremity 50%. Unidentifiable segments were seen in 60% of the datasets. Fetal movement was observed in 8 of 10 datasets, with significant variability seen in movement duration and portion of segment moving. On average, fetuses moved 25 seconds per dataset. Average head movement duration was 6.6 seconds (range: 3 seconds to 13 seconds), average upper extremity movement duration was 13.6 seconds (range: 3 seconds to 44 seconds), and average lower extremity movement duration was 4.6 seconds (range: 2 seconds to 15 seconds). In general, segments were

visible 80% of the time and moved 20% of the time they were visible. Annotating fetal movement patterns in a systematic way shows potential for establishing a criterion to define a typically developing movement repertoire.

CHAMP Improves Behavioral, but not Cognitive Self-Regulation Skills in Head Start Preschoolers

Leah E. Robinson, University of Michigan, Ann Arbor; Alison L. Miller, University of Michigan, Ann Arbor; Kara K. Palmer, University of Michigan, Ann Arbor; Hurley O. Riley, University of Michigan, Ann Arbor; Lu Wang, University of Michigan, Ann Arbor; Chang Wang, University of Michigan, Ann Arbor

Motor competence and self-regulation develop rapidly in early childhood and share common fundamental processes such as planning sequenced actions, controlling body movements, and engaging in goal-directed activity. Yet, motor competence is not considered central to most conceptualizations of early self-regulation. Emerging work suggests motor competence interventions may hold promise for promoting self-regulation in preschoolers. However, such interventions have not consistently evaluated both behavioral and cognitive self-regulation outcomes, which is important in order to understand whether motor competence interventions support the development of specific self-regulation skills. We tested the impact of a motor competence intervention (Children's Health Activity Motor Program; CHAMP) on behavioral self-regulation among children attending Head Start. Grounded in Achievement Goal Theory, CHAMP encourages children's autonomy to navigate a mastery-oriented motor skill learning environment. Children (M age = 53.4 months, SD = 3.2) were cluster-randomized to intervention (n = 67) or control conditions (n = 45) by classroom. Behavioral self-regulation was assessed using the Head-Toes-Knees-Shoulders task (HTKS). Cognitive self-regulation was assessed using working memory and dimensional card-sorting tasks from the Early Years Toolbox. Results: Random-effects hurdle models accounting for zero-inflated distributions indicated that children receiving the CHAMP intervention, compared to not, were almost 3 times more likely to have non-zero scores at post-test on the HTKS; OR: 2.98 (CI 1.53, 5.81). CHAMP did not show an impact on cognitive self-regulation outcomes (all ps>.05). CHAMP is an ecologically valid strategy for preschoolers that may have a greater impact on behavioral, compared to cognitive self-regulation outcomes. Funding: National Institutes of Health NHLBI/OBSSR R01-HL-132979 02S1 Funding source: National Institutes of Health NHLBI/OBSSR R01-HL-132979 02S1.

PACETECH: A Light-Based Technology to Set the Pace During the PACER Test

Luis Paulo Rodrigues, Instituto Politécnico de Viana do Castelo; Sérgio Ivan Lopes, Instituto Politécnico de Viana do Castelo; Filipe Manuel Clemente, Instituto Politécnico de Viana do Castelo; Pedro Bezerra, Instituto Politécnico de Viana do Castelo; Pedro Moreira, Instituto Politécnico de Viana do Castelo; João Passos, Instituto Politécnico de Viana do Castelo; Rui Silva, Instituto Politécnico de Viana do Castelo

Maximal oxygen uptake (VO2max), expressing the maximal aerobic power of and individual is considered the best index of cardio-respiratory fitness (CRF) which in turn, is an important lifespan cardiovascular health marker. Maintenance of satisfactory CRF levels is related with the prevention non-communicable diseases as cardiovascular disease, diabetes and obesity. The progressive aerobic cardiovascular endurance run (PACER) test is used as a valid measure for CRF testing all over the world, but it is difficult to carry on the PACER test in an epidemiological typical setting, namely with children. To run as far as possible while keeping a specified pace implies a continuous running regime throughout the test. However, in reality, the PACER test is self-paced as the only stimulus to set the pace during the test is a beep sound at the start and end of each 20-meter straight line course, which children as young as 6- to 10-years-old have difficulty to manage. This presentation shows the development and validation of an electronic digital prototype for externally setting continuously the pace of the PACER test. This apparatus, the PACETECH (patent pending) is portable, internet-connected, price affordable, and controlled via a digital App (Smartphone), allowing not only, its operational control, but to record and track individual PACER test results over time in an online approach. The PACETECH is modular scaled, beginning with a base kit and the possibility of adding modules for more specific assessment, registry, and results presentation. The reliability and validity of the prototype will be piloted relatively to a laboratory VO2max test, a VO2max field test, and the normal PACER test. Pilot results will allow to understand the usefulness of the PACETECH to a more reliable assessment of children's VO2max. Funding source: Norte-01-0145-FEDER-000043 – Project TECH – Technology, Environment, Creativity and Health.

Estimation of the Best Method for the Calculation of the Subscales and Total Scores of the Motor Competence Assessment (MCA)

Luis Paulo Rodrigues, Instituto Politécnico de Viana do Castelo; Rita Cordovil, Universidade de Lisboa; Carlos Luz, Instituto Politécnico de Lisboa; Vitor P. Lopes, Instituto Politécnico de Bragança; André Pombo, Instituto Politécnico de Lisboa

The MCA (Motor Competence Assessment) is an instrument to assess motor competence (MC). along the lifespan. For the first time, we can assess MC from childhood to old age using the same instrument, without an age ceiling effect and of feasible and objective execution. After establishing the MCA construct validity, the six tests' normative values from childhood to young adulthood were published, and recently, the invariance of the MCA across age groups was assessed. The aim of this study is now to find the best method for the calculation of the subscales and total MCA scores. One thousand participants representing four age group subsamples (3-to-6, 7-to-10, 11-to-16, and 17-to-22 years) with 250 participants each, were assessed on the MCA, and their results on the sub-scales were calculated according to three different methods: (1) a general factor score index, where each item's weight is derived from its factor loading of the MCA model; (2) an age-group factor score index, where each item's weight is derived from its factor loading of the respective age-group MCA model; and (3) an equal score index with a non-weighed participation of each test for the subscale calculation. Each subscale was calculated using the three tested methods, and the results compared using bivariate correlations and intraclass correlations for the all sample and for each age-group sub-sample. Results showed a very high agreement between the three methods tested with intraclass correlations and bivariate correlations values higher than 0.99. These results allow to conclude for the use of the simpler method for calculating the MCA subscales, there is to use equal weights for each test. In conclusion we suggest that, after being transformed into age and sex normative values (percentiles), an average of the two tests of each MCA subscale can be used to adequately represent the individual motor competence on that category (locomotor, stability, or manipulative), and a total MCA score can be found by the average of all six tests. Funding source: LPR and VPL work was supported by the Portuguese Science Foundation (FCT) under Grant number UID04045/2020. RC work was supported by the Portuguese Foundation for Science and Technology, Grant UIDB/00447/2020 to CIPER.

Examining Visual Learning Strategies During a Contingency Paradigm in Infants

Marcelo R. Rosales, University of Southern California; Weiyang Deng, University of Southern California; Jose Carlo Pulido, Universidad Carlos

III de Madrid; Nina S. Bradley, University of Southern California; Maja J. Matarić, University of Southern California; Beth A. Smith, Children's Hospital Los Angeles

Infant contingency learning has been considered an implicit learning task. However, there is growing literature to suggest infants use cognitive strategies to learn contingency learning paradigms. Therefore, to better comprehend how infants learn contingency paradigms, it is important to identify and examine the behavioral strategies used during these paradigms. In this study, we examine how infants use visual behavior while learning a contingency paradigm. We hypothesize that there will be an association between the number of times infants visually anticipate (visual anticipation score, VAS), the duration of time spent looking (TSL) and time to produce a reinforcement (TPR). Pilot data from 4 infants (6-9 months) were used. The contingency learning task involved reinforcing the infant's right leg movement with a robot kicking a ball. Head-mounted eye-tracking was used to estimate the position of the infant's gaze during the task. Trained personnel, performing a frame-by-frame video analyses, identified each robot activation. They then identified each time the infant looked at the robot (onset and duration). Predictive gaze was defined as a gaze shift with a visual fixation on the robot 0-400ms prior to its activation. VAS was calculated using a moving window for 3 reinforcements where higher scores reflected more consecutive anticipatory gazes. We used Spearman correlation to measure associations between VAS, TSL, and TPR. Three of the 4 infants had a positive correlation between TSL and VAS ($p < 0.05$). Three of the 4 infants did not have a correlation between TPR and VAS ($p > 0.05$). It appears that our small sample used visual gaze in a variety of ways to learn the contingency paradigm. However, visual attention (i.e., TSL) seems to be related to how often visual anticipation occurs (i.e., VAS) and is potentially showing evidence of an important cognitive strategy for learning contingency paradigms. We will continue to collect data and refine our statistics for visual gaze data in the assessment of contingency learning. Funding source: National Science Foundation (NSF CBET-1706964).

Experiential Influence on Dynamic Stability While Learning to Walk: A Case Study

Jennifer Sansom, Central Michigan University; Kerby Tamm, Central Michigan University; Megan Zahn, Central Michigan University; Katelynn Toloday, Central Michigan University

Development of independent walking is typically studied in research labs that are unfamiliar to infants and home environments in which they live and learn movement. Both approaches provide important insights about emergence of walking but are typically performed in isolation of the other. We used a bimodal approach to longitudinally examine changes in gait characteristics (lab) and gross motor behaviors (home) for a typically developing male infant who was 11 m old at walk onset. Our participant was tested for 3 months after walk onset in a research lab and home. In the lab, he was tested monthly (4 visits). A 12-camera motion capture system recorded him walking across a 6-meter walkway. During bimonthly home visits, he was video recorded during typical activities for 60-minutes (7 visits). Activities were coded using Datavyu for Independent (falling, kneeling, lying, rolling, sitting, squatting, standing), Supported (supportive: person, sitting, standing), and Locomotion (climbing, cruising, crawling, walking) gross motor behaviors. By the 4th lab visit, the infant walked more quickly (+178.91%) with longer (+68.85%), narrower strides (-28.14%), and shorter double limb support phase (-29.38%). At home, from Visit 1 to Visit 7, the infant performed more frequent Independent (+31.11%) and Locomotion (+29.01%) behaviors and fewer Supported (-46.44%) activities; the proportion of time spent in Independent behaviors was almost unchanged (-4.87%), but duration of Locomotion increased (+113.03%) while Supported decreased (-36.33%). Our findings show that as the infant spent more overall time and more frequently engaged in Locomotive gross motor behaviors, he needed less frequent support, suggesting improvements in dynamic postural control strategies. These progressive shifts may have been detected in his overt gait characteristics during lab visits. However, further research including data collections in both lab and home environments with a larger sample of new walkers is necessary.

Physical Literacy in Germany: PlaySelf and PL-C Quest – Same or Different?

Nadja Schott, University of Stuttgart

While the physical literacy framework model (PL; PA-related competencies, motivation, confidence, knowledge, and understanding) is already relatively widespread internationally, the concept has only been taken up sporadically in German-speaking countries in recent years. Valid measures of PL are needed to assess the effectiveness of interventions aimed at increasing children's PL (Jean de Dieu & Zhou, 2021). However, no such measures exist in Germany. This study aimed to translate the questionnaires PlaySelf from the Canadian Sport for Life Society and the PL-C Quest from Sport Australia into German, test the measurement properties, and compare both instruments in a sample of school children aged 6 to 14 years. A total of 389 children (boys = 199, girls = 190; age = 10.8 ± 1.45 years) completed the questionnaires. The PLAYself questionnaire showed for Physical literacy self-description ($\alpha = 0.90$) and the relative rankings of literacies (literacy, numeracy, physical literacy; $\alpha = 0.79$) a good internal consistency compared to Environment ($\alpha = 0.63$). The PL-C Quest showed only for the physical dimension ($\alpha = 0.81$) a good internal consistency compared to the cognitive ($\alpha = 0.69$), psychological ($\alpha = 0.69$) and social dimension ($\alpha = 0.68$). Older girls' physical literacy was lower compared to boys. Age- and sex-controlled PLAYself Physical literacy total scores positively correlated with the PL-C physical ($r = .70$**), psychological ($r = .61$**), cognitive ($r = .54$**), and social dimensions ($r = .40$**). Confirmatory factor analysis of the four-factor model of the PL-C Quest showed an acceptable fit (PCMIN/DF = 2.13; CFI = .896; RMSEA = 0.053). Overall, both translated instruments provide us with the possibility of assessing physical literacy for researchers and practitioners. Further research is needed to validate the PlaySelf and the PL-C Quest as longitudinal monitoring tools and as a pre-and-post measurement on the impact of interventions related to physical literacy in the kindergarten and primary school setting.

Fundamental Movement Skills Proficiency in Children, Adolescents and Older Adults

Nadja Schott, University of Stuttgart; Benjamin Holfelder, University of Stuttgart

Health and motor performance are central aspects of people's lives, and both have in common that they are related to physical activity, with this relationship increasing in importance for the quality of life with increasing age. Declining involvement in physical activity and declining motor skills are inextricably linked. However, although individual motor skill components may decline with age, overall performance can remain the same because of increased reliance on other aspects of performance. Limited evidence exists for the development of gross motor skills in older adults compared to children. This study aimed to investigate fundamental movement skill proficiency in 428 participants (32 older adults [64.1 ± 8.64 years, 59% female], and 396 children (8.22 ± 1.48 years, 54% female]). The proficiency of 6 locomotor and 7 object-control skills was video-assessed using the Test of Gross Motor Development (TGMD-

3). As anticipated, significant differences were found for age on all skills, but striking, Wilks-Lambda = 0.27, $F(52,1210) = 9.49$, $p < 0.001$. Gains from early childhood characterized the changes through to early adolescents, beyond which older adults exhibited only for hoping, jumping, and throwing a decrease in performance. Significant sex differences favoring boys/men were found for running, striking, dribbling, kicking, and throwing, Wilks-Lambda=0.64, $F(13,312)=13.4$, $p < 0.001$. The results also indicated that 2.3%/2.3% of the participants in early childhood, 17.3%/1.2% in middle childhood, 20.4%/3.4% in late childhood, 37.8%/18.9% in early adolescents, and 28.1%/3.1% in older age mastered all their locomotor ($X^2(24)=90.1$, $p < .001$) and object control skills FMS ($X^2(28) = 166$, $p < .001$), respectively. Motor skills appear to be more resistant to age-related decline than physiological factors, such as strength exercise. Although performance components may decline, increases in a compensatory skill seem to allow for performance stability over time.

Measuring the Impact of an Elementary Physical Education Class Warm up Intentionally Designed to Improve Object Control Skills

Dwayne Sheehan, Mount Royal University; Sonia Sheehan, Foundations for the Future Charter Academy

This exploratory study was designed to determine the improvement (and perceived improvement) of fundamental movement skills (FMS) when children ($N = 48$, $M_{age} = 9.6 \pm 1.9$ *years*) in two fourth grade classes were provided a physical education (PE) warm up experience that emphasized the use of object control skills (OCS). All children participated in a daily 30-minute PE class over an 8-week period. Each class began with a specific OCS warm up activity that may have included dribbling, striking, catching, throwing, and/or kicking, for approximately 3-5 minutes. OCS were measured before and after the intervention using the Canadian Agility and Movement Skill Assessment (CAMSA), the Test of Gross Motor Development (TGMD3), and the Bruininks-Oseretsky Test of Motor Proficiency (BOT2). The self perception of the children's own motor skills was measured using the Perceived Motor Competence in Childhood (PMC—C) questionnaire. The PMC-C has subscales that include some OCS such as throwing, catching, and kicking. Human research ethics approval was provided by the Mount Royal University ethics board (#100827). Body mass index was calculated and converted to Z scores, and no significant differences were found amongst the participants (*male n = 28, Z = 0.2, female n = 20, Z = 0.1*). Statistically significant improvements between pre and post testing were seen in the CAMSA, TGMD3, and BOT2 measurements ($p = <0.01$). There was no change in the PMC—C total score ($p = 0.599$) or any of the subscale scores between pre and post testing. Results of the regression modeling showed there were no pre-test or post-test differences between gender for both the BOT2 and PMC-C. However, males scored higher than females on the CAMSA and TGMD3 at pre-testing ($p < .001$), and higher at post-testing on the TGMD3 ($p = 0.041$) only. Both genders improved significantly on these measures, yet scores for females were trending closer to the males at post-testing on both. These results provide an indication that an emphasis on OCS during PE warm up activities may improve FMS particularly for females.

Changes in Actual and Perceived Fundamental Motor Skill Competence Across Childhood

Blaize Shiebler, The Ohio State University; Jacqueline D. Goodway, The Ohio State University; Sue Sutherland, The Ohio State University; David F. Stodden, University of South Carolina; Ali Brian, University of South Carolina; Larissa True, New Mexico State University; Rick Ferkel, Central Michigan University; Dimetri Brandon, The Ohio State University; Ruri Famelia, The Ohio State University; Obidiah Atkinson, The Ohio State University; John Taylor, The Ohio State University

Fundamental motor skill competence (FMSC) and perceptions of motor competence (PMC) are key underlying mechanisms driving physical activity behaviors across childhood. Yet many children are vulnerable to physical inactivity due to low levels of FMSC and PMC. This study examined gender and age-related changes in FMSC and PMC across early childhood (EC: 4-5 yrs, $n = 139$), middle childhood (MC:7-8 yrs, $n = 131$), and later childhood (LC:10-11 yrs, $n = 137$) with 209 girls and 198 boys. The TGMD2 measured FMSC and Harter's Physical/Athletic Competence subscale measured PMC. Three, 3 Age X 2 Gender ANOVAs were conducted on: 1) object control standard score (OCSS), 2) locomotor standard scores (LocSS), and 3) PMC mean scores. Overall, children were delayed in FMSC (5th-16th percentile) with "pretty good" PMC ($M = 3.20$). For OCSS, LOCSS and PMC, there were no significant Gender differences or interaction effects. However, there was a significant Age effect for OCSS ($p < .001$), LOCSS ($p < .001$), and PMC ($p < .001$). For OCSS, significant post-hoc tests revealed children in EC were better than those in MC, and children in LC were significantly higher than EC/MC. For LOCSS, significant post-hoc tests revealed children in EC and LC were similar, but both were significantly better than children in MC. For PMC, significant post-hoc tests revealed children in EC and MC were similar, but both were significantly better than those in LC. These findings reflect the literature with no gender differences in LOCSS but contradict the literature for OCSS. This may be due to children being so low in FMSC that there was little room for variation in scores. There was a clear mismatch between low FMSC and higher PMC in all age groups. Interestingly, despite standard scores accounting for age-related changes in FMSC, there were significant Age main effects with children in MC being the most vulnerable. Not surprisingly, children in LC had the lowest PMC and more in line with their actual FMSC. These data have implications for practitioners.

Understanding the Role Preschoolers Body Composition and Physical Activity Levels Play in FMS Development

Katherine E. Spring, Auburn University; Alexandra V. Carroll, Auburn University; Danielle D. Wadsworth, Auburn University

Physical activity (PA) is a pathway to reduce the risk of obesity and associated chronic diseases. There is evidence that improvements in PA can lead to benefits in other areas of development, including fundamental motor skills (FMS). FMS are considered the building blocks of movement and are often deficient in overweight and obese children. Unfortunately, the roles physical activity and body composition (fat-free mass (FFM) and fat mass (FM)) play in FMS are not fully known in preschoolers. This study aimed to determine if physical activity and body composition were predictors of FMS. Preschoolers ($n = 46$) from two preschools were assessed for FMS, PA, and body composition. Peabody Developmental Motor Scales (PDMS-2) subscale scores were used to assess FMS in terms of stationary (SS), locomotion (LS), and object manipulation skills (OMS). To assess PA, preschoolers wore an accelerometer on their wrist for five days during school. Age-specific cut-points were used to determine time spent in light physical activity (LPA) and moderate-to-vigorous physical activity (MVPA). Body composition was measured with foot-to-foot bioelectrical impedance. Participants had a mean age of 4.25 ± .673 years. Participants were primarily females (52.2%), and most participants were Caucasian (80.4%). Participants averaged 148.74 (± 32.71) minutes of LPA and 99.29 minutes (± .25.66 minutes) of MVPA per day. The majority of participants received an average score for SS (60.9%), OMS (58.7%), and LS (78.3%). Results of linear regressions indicate significant models for SS ($F = 4.01$, $p = .008$) and OMS ($F = 4.316$, $p = .005$). FFM was the only significant predictor of SS ($t = 3719$, $p = .001$) and OMS ($t = 3.179$, $p = .003$). FM, LPA, and MVPA were nonsignificant predictors in all models. These results further indicate that greater levels of FFM are

associated with higher SS and OMS scores. Interventions that target improving and or maintaining FFM may result in improvements in FMS.

What Can Location Tell Us About Infant Physical Activity?

Alicia Springfield, California State University, Fullerton; Joao Barros, California State University, Fullerton; Do Kyeong Lee, California State University, Fullerton

During the first year of life, infants experience levels of physical activity; the quality and quantity of which remain uncertain. Due to the accessible manner by which researchers study infant physical activity via walking skills, there is an absence of observations, within the first year of life. To fully capture infant physical activity, the spontaneous movement of 9 infants (6 f/3 m, 1.3-12.2 months) was observed at monthly home visits. The researcher immersed themselves into the environment to record the infant's spontaneous movement for 20-30 minutes; without intervention. Video data showed infants naturally moving (e.g., spontaneous movement) through various locations. Location observations were categorized into restrictive locations (e.g., held) or nonrestrictive locations (e.g., on the floor). Data analysis consisted of frame-by-frame video coding; determining the frequency and duration of infant activity, across all locations. In this way, physical activity was operationally characterized by the presence of any infant movement. The preliminary data displayed significant differences in restrictive and nonrestrictive locations, over the observational period [Ps < 0.05]. Meaning, infants not only spend less time within restrictive locations (3.25-42%) but also spend more time in nonrestrictive locations (57.90-96.74%) longitudinally. A significant difference in floor time [$p < 0.01$] suggests that infants increase time within this location (14.19-92.8%, $M = 65.52\%$) over the observational period. While, the significant difference in time being held across the observational period [$p < 0.05$]; indicates that caregivers utilized this location less longitudinally (2.9-33.05%, $M = 15.85\%$). Conclusively, while the data remains in its preliminary stages, it demonstrates that the time infants spend in different locations may dictate their movement, or ability to be physically active.

Extending the TGMD-3 Normative Sample of Children With Autism Spectrum Disorder

Kerri L. Staples, Texas Woman's University; Leah R. Ketcheson, Wayne State University; Phil M. Esposito, Texas Christian University; Dale A. Ulrich, University of Michigan

The Test of Gross Motor Development (TGMD-3) is the most widely used measure of gross motor competence to determine gross motor impairment and eligibility for services. As a result, the normative sample for the TGMD-3 purposefully included a representative sample of children with disabilities. With 1 in 44 school-aged children having an autism spectrum disorder (ASD) diagnosis, practitioners are administering the TGMD-3 to an increasing number of children with ASD. Although comparison of scores to the normative sample provides an indication of motor competence relative to other children of the same age and gender, there is also a need to understand competence of children with ASD to a reference group of other children with ASD. The purpose of this study was to extend the sample of children with ASD who are included in the TGMD-3 normative sample. The TGMD-3 normative sample included 33 children with ASD ($M_{age} = 89.45$ months); the additional sample included 48 children with ASD ($M_{age} = 77.79$ months). Because the TGMD-3 utilizes a developmental framework, an ANCOVA that controlled for age ($M_{age} = 82.54$ months) was used to examine differences in TGMD-3 scores. No significant between-group differences were found and samples were combined to provide a larger reference group of children with ASD who spanned the full age range for which the TGMD-3 is standardized. The complete sample included 81 children with ASD (67 boys, 14 girls), which provides a representative ratio of 4.36 boys for every girl. The TGMD-3 was administered and scored using standardized procedures. When descriptive terms were used, 46% and 59% of locomotor and ball skills subtest scores were described as impaired or borderline impaired. The Gross Motor Index of 67% of children with ASD were described as impaired or borderline impaired and an additional 11% were described as below average. Given the extent of motor impairment among children with ASD, targeted instruction needs to extend into the community to provide additional opportunities to gain motor skill competence. Funding source: Organization for Autism Research; W.K. Kellogg Foundation.

Exploring Factors That Predict the Change in Parents' Perceptions of Their Child's Motor Competence

Alexandra Stribing, University of South Carolina; Sally Taunton-Miedema, University of South Carolina; Chandler Casner, University of South Carolina; Stephen Griffin, University of South Carolina; Ali Brian, University of South Carolina

Parents, including their perceptions, tend to be influencers of their child's motor development starting at a young age. However, it is important to explore factors that may influence a change in parents' perceptions given their predictive power. Unfortunately, change in parents' perceptions of their child's motor skill competence is relatively unknown for young children. Therefore, the primary purpose of this study was to explore which factors predicted change in parents' perceptions of children's motor competence. A secondary purpose included an evaluation of the effects of a motor skill intervention on children's motor competence. Parents of preschool aged children ($N = 193$; mothers = 58.2%, fathers= 5.3%; $M_{age} =$ 33.09 years, $SD = 7.85$ years) completed the parents' perception questionnaire and the little developmental coordination disorder questionnaire (Little DCD-Q). A backward linear regression examined if DCD-Q scores, and other factors, predicted change in parental perception of children's motor skills. A paired samples T-test determined if motor skills (DCD-Q) changed from pre to post intervention. Results show total amount of intervention sessions attended and DCD-Q significantly predicted change in parents' perceptions of their children's motor competence ($F[2, 85] = 5.32$, $p < .007$, $adjR^2 = .09$). Additionally, DCD-Q scores changed from pre intervention ($M = 4.45$, $SD = .60$) to post intervention ($M = 4.61$, $SD = .53$) with a statistically significant mean increase of 0.15 (95% CI [0.04, 0.25], $t(126) = 2.80$, $p < .006$, $d = .61$). Parents may be the change agents to their child's motor skill development. If parents can deliver a motor skill intervention their children can learn and develop their motor skills. Given the increased need for virtual programming due to the COVID-19 pandemic, future research should examine the effectiveness in using an application to deliver a parent-child movement intervention. Funding source: NIH Grant #P20GM130420 and Duke Endowment.

Associations Between Infant Eye Gaze and Performance in a Socially-Assistive-Robot-Reinforced Contingency Learning Task

Willis Tang, University of Southern California; Weiyang Deng, University of Southern California; Celeste Vazquez, University of Southern California; Marcelo Rosales, University of Southern California; Maja J. Matarić, University of Southern California; Beth A. Smith, Children's Hospital of Los Angeles

Visual attention plays a critical role during learning processes in infants, with previous literature suggesting that differences in gaze patterns and visual attention may be associated with different learning and memory outcomes. During a contingent learning task, some infants learned the contingent relationship while others did not. Differences in visual

behavior may help explain the differences in their task performance. We aimed to examine the association between visual fixation duration on the NAO humanoid-socially-assistive robot and infant performance, hypothesizing that infant performance ratio is positively correlated with the duration of visual fixation towards the robot. Nine infants (6-8 months old) participated in this study, with 3 infants born preterm (<32 weeks gestation) and 6 infants with typical development. Infants wore a head-mounted eye tracker (Positive Science) and were seated in front of a robot that reinforced infant right leg movement. The task included a 2-minute baseline (no reinforcement) session followed by an 8-minute contingency session (reinforcement) and 2-minute extinction session (no reinforcement). Infants who demonstrated >1.5 times the quantity of qualified leg movement in at least one 2-minute contingency block compared to the baseline were labeled as "performers". Two trained personnel identified each visual fixation using a frame-by-frame analysis. We used Spearman's correlation coefficient to examine the relationship between the duration of visual fixation on the robot within the peak block (2-minute block with the highest movement quantity above the contingency threshold) and their performance. A positive correlation was found between visual fixation duration on the robot and infant performance ratio (rho = 0.75, $p = 0.02$). Infant performers had a higher average visual fixation duration (71.2s) than the non-performers (27.5s). Future studies should explore the differences in performance between infants born preterm and infants with typical development as well as identify gaze patterns during visual fixation periods. Funding source: NSF; SC-CTSI voucher grant.

Evidence of Role Differentiated Bimanual Manipulation in Infants During Free-Play

Paige Thompson, Purdue University; Emily Shalit, Purdue University; Alyssa DeJoan, Purdue University; Frances Kornelik, Purdue University; Olivia Nicholson, Purdue University; Amanda Arnold, Denison University; Satyajit Ambike, Purdue University; Laura Claxton, Purdue University

One- and two-object role differentiated bimanual interactions (RDBM) occur when one hand stabilizes an object and the other manipulates an object. When opening a jar, one hand stabilizes the jar and the other twists the lid. When cutting a loaf of bread, one hand stabilizes the bread and the other cuts with a knife. RDBM in infants is assessed in structured tasks with toys designed to elicit RDBM. These studies have identified key developmental trends: RDBM occurs 20% and 50% of the time in 13- and 36-mo-olds, respectively; 13-mo-olds stabilize first before manipulating, and have more two-object than one-object RDBM; and while 13-mo-olds use the same hand for each role only 50% of the time, 24-mo-olds are 100% consistent (Gonzalez et al., 2015; Kimmerle et al., 1991; 2010). While informative, structured tasks miss how RDBM emerges in naturalistic settings, where factors such as infant toy preference may impact behavior. Our study determined the frequency, sequencing, and consistency of RDBM in a 20-minute free-play session where infants played in a toy-filled room. Using Datavyu, a video-coding program, coders identified at least one instance of RDBM in 17 13-mo-olds (8 male) and 22 24-mo-olds (12 male). During free-play, RDBM occurred infrequently (9-10% of all bimanual object interactions in 13- and 24-mo-olds). Unlike previous research, both ages had more instances of one-object RDBM (13-mo: $M = 87\%$, SE = 8; 24-mo: $M = 83\%$, SE = 7; $F(1,37) = 47.53$, $p < .001$). Similar to previous research, infants stabilized toys before manipulating them (13-mo: $M = 94\%$, SE = 0.1; 24-mo: $M = 86\%$, SE=0.1; $F(2, 74) = 169.34$, $p = .001$). Surprisingly, when 13-mo-olds engaged in multiple instances of RDBM they were 100% consistent in using the same hand for each role, whereas 24-mo-olds were only 39% consistent. Thus, there were key differences in the infants' behaviors in naturalistic settings compared to a structured task, which highlights the importance of assessing infant motor development in naturalistic settings. Future research will identify the specific factors underlying these differences.

Infant-Robot Interaction: Where are Infants Looking?

Celeste Vazquez, University of Southern California; Weiyang Deng, University of Southern California; Willis Tang, University of Southern California; Maja J. Matarić, University of Southern California; Beth A. Smith, Children's Hospital Los Angeles, University of Southern California

While previous literature suggests socially assistive robots (SAR) can encourage infant motor learning and imitation, it is unclear which features of the SAR attract infants' attention most during infant-robot interaction. This work analyzed: 1) infants' eye-gaze durations toward a SAR's face (salient attractor for infants) and moving legs (provided contingent reinforcement) during a contingency learning task; and 2) the difference of eye-gaze durations between infant performers and non-performers. Performers are the ones that generated 1.5 times more movements during a 2-min block in the contingency session compared to the baseline. We predicted longer eye-gaze durations on the robot's legs than on its face, and longer durations toward the SAR's legs by the performers than the non-performers. We used data from 10 infants (6-8 months; 3 infants born preterm (<32 weeks gestational age) and 7 infants with typical development). For the task, infants wore a head-mounted eye-tracker and were placed in a chair facing a SAR that provided a contingent response (kicking both legs, flashing eyes, and laugh sound) to the infant's right leg movement. The task began with a 2-min baseline, followed by an 8-min contingency, and concluded with a 2-min extinction. Using ELAN (v6.1), eye-tracking videos were annotated to identify where the infant was looking (whole robot, robot's face, robot's legs). Using a paired-sample *t*-test, the average ($M \pm SD$) time infants spent looking at the robot's legs per min (15.49 ± 12.59 sec) was found to be significantly longer than the time spent looking at the robot's face (2.25 ± 0.74 sec), $p = 0.013$. Furthermore, using one-way repeated measures ANOVA, significant differences between the performers and non-performers were identified in the eye gaze duration towards the whole robot ($p = 0.015$) and towards the robot's legs ($p = 0.013$), but no difference was found for eye gaze duration on the robot's face. Future studies should investigate how to incorporate this information in SAR intervention design and optimize developmental outcomes.

The Impact of Teacher Verbal Prompting and Demonstrated Modeling on Preschoolers' Physical Activity Levels

Danielle Wadsworth, Auburn University; Ali Carroll, Auburn University; Katherine Spring, Auburn University; Darby Winkler, Auburn University; Kameron Suire, Auburn University

Current research suggests that preschool physical activity (PA) interventions that target teacher-led strategies have the highest beneficial outcomes for children's PA levels. Specifically, intervention strategies that target teacher involvement through verbal prompting and demonstrated modeling can increase preschoolers' PA levels. The purpose of this study was to determine which teacher-led strategy, demonstrated modeling or verbal prompting, elicits higher levels of PA among preschoolers. 116 preschoolers (M age 3.69±.62 years; 88% Black) from 10 classes at one Head Start center participated in the study. Teachers' verbal prompting and demonstrated modeling were assessed utilizing the System for Observing Student Movement in Academic Routines and Transitions (SOSMART) instrument. An actigraph accelerometer worn on the hip during observation days measured PA. SOSMART and PA data were collected on four school days over a two-week period. The average number of teachers' verbal prompts and demonstrated modeling across the four days from each class and

preschoolers' percent of time spent in light and moderate to vigorous physical activity (MVPA) were analyzed. The MANOVA results showed verbal prompting differed significantly between segments of the preschool day ($p < .001$), most often occurring during work time ($p = .014$). MANOVA results also showed a significant ($p = .032$) difference in teacher demonstrations throughout the day, however, post-hoc analysis showed no significant differences between segments of the school day. A forward stepwise linear regression showed that preschoolers' MVPA ($B = 1.331$, $\beta = .802$, $t = 3.796$, $p = .005$) and MVPA and light PA ($B = 1.511$, $\beta = .910$, $t = 2.596$, $p = .036$) were correlated to the level of teacher demonstrated modeling. Teacher verbal prompting was not a significant predictor of MVPA nor light PA. Interventions that encourage teachers to demonstrate and model physical activity may provide a viable strategy to increase physical activity for preschoolers.

Evidence Base for Designing Intervention an Adapted Golf Intervention Program for Youth With Autism Spectrum Disorder Using Newell's Constraints

Rio Watanabe, The Ohio State University; Jacqueline Goodway, The Ohio State University; Samuel Hodge, The Ohio Stat University

The Centers for Disease Control and Prevention (2021) estimates that 1 in 54 children are identified with autism spectrum disorder (ASD). Many youth with ASD struggle to find meaningful recreational opportunities, especially in team sports due to challenges in communication (Scharoun et al., 2017). Golf is a popular lifetime activity with approximately 37.5 million playing in the USA in 2021 (National Golf Foundation, 2021). It is potentially a good activity for youth with ASD because it can be played individually and has a significant structure. The purpose of this presentation is twofold: 1) to provide a review of the adapted physical education and motor development literature that might inform the development of a golf intervention for youth with ASD using Newell's constraints (individual, environmental, task), and 2) to provide an overview of a theoretically mapped golf intervention for youth with ASD highlighting the individual constraints that need to be considered, the types of manipulation of environmental constraints, and the kinds of developmentally appropriate golf tasks. A review of the literature revealed many youths with ASD present a variety of individual constraints that need accommodating in the instructional process. Some structural constraints often reported in the literature are toe walking, low muscle tone, and a propensity for overweight (Pope et al., 2012). Other, individual constraints included struggles with sustained attention on new tasks, limited problem-solving skills, and difficulty in performing complex tasks. To accommodate these individual constraints, a summary of the literature on task modification and environmental adaptation was undertaken to create novel golf programming for youth with ASD. Some of the key findings on modifications from the literature were, 1) modification of equipment and rules, 2) use of color-coding, 3) personal preference, and 4) structured organization of environments. The presentation will conclude with an overview of the initial golf program for youth with ASD and implications for future research. Funding source: N/A.

PLAY: Parental Engagement and Intervention Fidelity in a mHealth Motor Skills Intervention in Early Childhood

E. Kipling Webster, Augusta University; Amanda E. Staiano, Pennington Biomedical Research Center

With the expanding use of mHealth technology to administer interventions to a wide audience, work is needed to examine how users engage with and implement fundamental motor skills (FMS) and physical activity (PA) interventions in home-based settings. The purpose of this project is to examine the intervention fidelity of a mHealth intervention targeting FMS in preschool children. 72 children (4.0 ± 0.8 years; 57% female) and parents completed a 12-week mHealth intervention. Parents accessed an app that delivered content, curriculum, videos, and activities for their preschool-aged child, focused either on FMS development or on unstructured PA (UPA; "free play"). Brief videos were provided to each group, the FMS group viewed children demonstrating FMS and activity break activities and the UPA group viewed information promoting free play. Parents were asked to complete five 12-min activity bouts each week for a total of 720 minutes. Fidelity was measured by dyad-report for each activity bout completed as well as app usage data. In total, parents reported completing 47 of the 60 prescribed activity breaks ($M = 564$ mins), with similar adherence in the FMS (71%) and UPA (87%; $p > .05$) groups. The FMS group accessed on average 20 videos (44 total video views). Video viewership declined over the course of the 12-weeks. Qualitative feedback from weekly adherence and acceptability surveys indicated parents were highly satisfied with the app, but they noted several opportunities to improve usability and adherence. Overall, this mHealth app-based project was found to be feasible and effective in preschool-age children and their parents to improve FMS behaviors. Adherence was similar, regardless of the content presented (FMS vs. UPA), providing confidence for more work using mHealth technology to target parent-mediated programs with preschool-age children. Balancing intervention fidelity and ecological validity is crucial to implementing this type of intervention, but mHealth inherently has limitations in terms of directly measuring fidelity without undue burden on the user. Funding source: This research was supported by R21HD095035 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the NIH and partially supported by NIH grants P30 DK072476 and U54 GM104940.

Motor Learning and Control Abstracts

Training Visuomotor Adaptation With Remembered Targets Improves Reaction Time in Different Workspace Locations

Reuben N. Addison, Louisiana State University; Jan M. Hondzinski, Louisiana State University; Arend W. A. Gemmert, Louisiana State University

Introduction: Visual feedback of hand and target location can influence strategies for visuomotor adaptation. Contributions of the hand and eyes during visuomotor adaptation are unknown yet would provide insights into adaptive control strategies used. Purpose: In this study we aimed to assess the effects of a visual feedback manipulation on movement adaptation of the hand and eyes in three workspace locations. Methods: Twenty-four right-handed young adults were recruited and pseudo-randomly assigned to one of two groups: visible (target remained on the screen throughout the movement) or remembered (target disappeared 0.5 s after appearance). Participants were instructed to draw a straight line with a stylus from a central to a peripheral target on a digitizer tablet with visual feedback of the pen trace. Participants wore a mobile eye-tracker. Adaptation training involved 45° rotation of visual feedback. Initial direction error (IDE), Pathlength (PL), Eye and hand reaction times (RT), and movement times (MT) before and after training on unrotated trials provided aftereffect assessments, while performance measures before and after training on rotated trials provided retention assessments in the Central (CEN), Ipsilateral (IPS), and Contralateral (CTL) workspace locations. A mixed factor ANOVA was performed on all variables with 3 workspaces (CEN, IPS, CTL) and 2 tests (pre-/post-training) as within subject factors and 2 target conditions (visible/not visible) as between subject factors. Significant effects were followed by Bonferroni corrected post-hoc tests. Results Participants reacted faster and moved faster and straighter after rotational adaptation except for Hand RT in the IPS location. Greater PL and IDE

aftereffects occurred in the CEN and IPS locations. Remembered group reacted faster post-training than pre-training and compared to the visible group post-training. Conclusion: Removing the target during rotational adaptation of directional information with visual feedback of movement improves RT for unrotated trials regardless of workspace.

Illusory Effects on Stepping Over Obstacles After Lower Extremity Muscle Fatigue

Abayomi Gideon Adeyemo, Louisiana State University; Tia Watts, Louisiana State University; Emily Randon, Louisiana State University; Shijun Yan, Shirley Ryan AbilityLab & Northwestern University; Jan M. Hondzinski, Louisiana State University

The application of illusions on raised surfaces of objects can increase toe clearance height when people step over obstacles. It is unclear how muscle fatigue of the lower limb would influence this performance, yet it could be of interest for populations that fatigue easily. In this study we wondered whether fatiguing young healthy adults would decrease toe clearance when stepping over obstacles or whether they would inherently overcompensate for force reductions that accompany fatigue. Seventeen participants (age = 20.3 +/- .77 years, height = 164.4 +/- 10.73 cm, and mass = 64.7 +/- 4.22 kg) walked at a comfortable pace along a straight path requiring steps over two obstacles with their dominant leg in fatigued and non-fatigued states. Shoe boxes were used as obstacles and included a plain or illusory (vertical lines) surface on the rise of the box. Participants produced full range of motion bilateral calf raises until they could not continue to induce lower limb muscle fatigue. We recorded passive markers placed on each participant's both hallux, ankles, knees, thighs, and shoulders during performance using a Qualisys motion capture system (Qualisys Medical AB, SE). Maximal toe clearance height (maxToe) during each step represented the primary variable of interest. A repeated measures ANOVA was used to determine whether maxToe was influenced by fatigue state (non-fatigued-NF; fatigued-F) and box rise surface (plain-P; illusory-ILL). Results revealed main effects of fatigue state and box rise surface on maxToe such that maxToe in NF and ILL exceeded F and P, respectively ($p < 0.05$). These results supported previous findings that the use of simple illusory vertical lines on the obstacle rise surface can encourage people to increase their toe clearance when stepping over obstacles. Additionally, lower limb muscle fatigue reduced the toe clearance in our participants regardless of box rise surface. Use of illusory surfaces on obstacles can help compensate for the reduced toe clearance that accompanies reductions in force production for people in a fatigued state.

You're Not on Mute Anymore: Lessons Learned From University Teaching During the Pandemic and Returning to In-Person Teaching

Sheila K. Alicea, St. Edward's University; Sarah Carson Sackett, James Madison University

The COVID-19 pandemic has impacted higher education significantly during the past two years. The purpose of this presentation is to discuss how university teaching changed during the pandemic, review lessons learned by faculty from two demographically-distinct institutions, and share how ideas, tools, and resources used to adapt to the pandemic's challenges and constraints continue to provide pedagogical value with a return to in-person teaching. In spring 2020, many faculty were faced with a sudden shift to emergency remote teaching. Faculty had varying levels of experience/preparation, and many were required to learn new technology and approaches to minimize the barriers this shift and new "classroom environment" presented. Universities continued to experience changes in course modalities and transitioned courses to online and/or hybrid versions in the semesters that followed, and instructional responsiveness and innovations continued to evolve. Throughout this time, faculty were also tasked with teaching during a pandemic that affected faculty and students in many ways and created a variety of challenges (e.g., experiencing COVID-19, loss of family/friends, social isolation, lack of childcare, diminished mental health). Despite these challenges, many resources were made available and lessons were learned to effectively support student learning in online and hybrid courses, including courses that have significant hands-on and collaborative components when offered in-person (e.g., motor development and learning). Specific examples from the presenters' lived-experiences, along with support from the growing literature in the area, related to maximizing features of learning management systems, maintaining active and collaborative learning techniques with accessible technology, and interpersonal strategies for engaging/motivating students in an online environment will be discussed. Now that many universities have returned to in-person teaching, specific examples of how these lessons and approaches can be implemented to elevate in-person teaching will be offered.

Feasibility of Online PD SAFEx™ Exercise Rehabilitation for Symptom Improvements of Parkinson's Disease: A Pilot Study

Quincy Almeida, Wilfrid Laurier University; Charlotte Jarvis, Wilfrid Laurier University; Kishoree Sangarapillai, University of Waterloo

Parkinson's Disease (PD) is a neurodegenerative disorder affecting both motor and cognitive symptoms. While medications show some improvement in motor symptoms, cognitive symptoms can worsen. In-person exercise pro[1]grams, such as PD SAFEx™, are an important adjunct therapy in improving symptoms. However, coronavirus disease 2019 (COVID-19) limited in-person exercise interventions. Therefore, there is a need to investigate the effectiveness of online exercise delivery. The primary objectives of this study were to identify (1) whether an online exercise intervention could achieve similar results to an identical in-person intervention and (2) if online PD SAFEx™ could alter the cognitive decline of PD patients. Twenty participants with idiopathic PD participated in a 12-week online PD SAFEx™ program and were compared to 73 participants from in-person PD SAFEx™. The primary outcome measure was motor symptoms severity measures by the Unified Parkinson's Disease Rating Scale-III which was measured before/after intervention. Three secondary cognitive measures were collected with the online group. Main effect of time on UPDRS-III scores of both groups were found ($F(1,92) = 35.555$, $p < 0.001$). No interaction was found between in-person and online groups ($F(1,1) = 0.052$, $p = 0.820$). TMT B in the online group showed significant improvements in executive function ($F(1,17) = 7.095$, $p = 0.016$). In conclusion, online and in-person PD SAFEx™ both achieved clinically significant UPDRS-III improvement and are statistically equivalent. Online PD SAFEx™ reduced cognitive symptoms seen during COVID-19.

Effect of Playful Practice on Learning a Novel Catching Task

David I. Anderson, San Francisco State University; Steven Kenny, Western Sydney University; Rebecca Millgate, Western Sydney University; Kylie Steel, Western Sydney University

Although researchers have championed deliberate practice as an effective way to facilitate motor learning, few studies have compared the efficacy of deliberate practice to other forms of practice. Here, we compared deliberate practice (DP) to a form of practice we dubbed playful practice (PP). We randomly assigned 24 participants (12 female, *M* age 39, *SD* 15) to a DP or a PP condition. Participants practiced a catching task for five 12-minute sessions followed by a 48-hour retention test and 7-day retention and transfer tests. The task required participants to flip and catch a pencil using two other pencils, one held by each hand. Participants flipped the pencil in

the opposite direction on the transfer test. On the first retention test, participants also rated how much they focused on achieving a goal and their motivation, enjoyment, sense of creativity, and confidence in performing the task. Both groups received written instructions about how to perform the task. We told the DP group to set challenging practice goals and work hard to achieve them. We told the PP group to deemphasize goal attainment and approach the task in an exploratory, playful way. The results revealed significant improvements in performance from practice block 1 to 5, $F(1, 22) = 19.5$, $p < .05$., but no differences between groups and no interaction between group and practice block. We found no group differences on the retention and transfer tests and on the measures of goal focus, motivation, enjoyment, creativity, and confidence (all $p > .05$). However, an interesting interaction on the first retention test revealed that participants in the PP group who were most focused on achieving a goal performed better than those who were least focused on achieving a goal, whereas the opposite was true for the DP participants $F(1, 18) = 11.5$, $p < .05$. In other words, participants who tended to disregard the instructions given to their group, were more successful on the first retention test. These preliminary findings suggest that the most effective type of practice might be individual-specific.

The Effect of a Holistic, Internal, and External Focus on Fine Motor Performance

Seungho Baek, Texas Woman's University; Hunter Alvis, Texas Woman's University; Cheng-Ju Hung, University of Florida; Hui-Ting Goh, Texas Woman's University; Kevin Becker, Texas Woman's University

The benefits of focusing attention externally rather than internally have been consistently reported in the literature (Wulf, 2013). However, the effects of using a holistic focus have not been well explored. A holistic focus directs one to think about the general feeling of the movement while performing the motor task (Becker et al., 2018). Recent studies have suggested that it may offer similar benefits to those of an external focus. The purpose of this study was to explore the effects of using a holistic, internal, and external focus on the performance and kinematics of a fine motor drawing task. Twenty-one healthy young adults (17 females) performed 40 trials of drawing a sine wave pattern on a digitizing tablet. The 40 trials consisted of 10 trials each in familiarization (FA), holistic focus (HF), internal focus (IF), and external focus (EF) conditions. Familiarization trials were always conducted first, and the focus condition order was counterbalanced between participants. In the focus conditions, participants were asked to focus on the movement of the pen (EF), focus on the movement of their hand (IF), and to focus on feeling smooth while drawing (HF). Pen tip trajectories were recorded through a digitizing pen and tablet at a sampling frequency of 130 HZ using Neuroscript Movalyzer Software. Spatial error, movement time, path length, normalized jerk, and pen pressure were calculated using a custom MATLAB code. Repeated-measures ANOVAS assessed differences due to the four focus conditions, and Sidak post-hoc tests were used for pairwise comparisons. Results showed that pen pressure with a HF was lower than FA ($p = .040$) and an IF ($p = .047$), but did not differ from an EF ($p > .05$). Path length was greater during IF than FA ($p = .002$). No differences due to focus were detected in any other variables ($ps > .05$). Overall, attentional focus appeared to have a limited influence on the production of the drawing movement, but did not affect outcome measures such as movement time and spatial error.

Memory Preservation and Generalization Following Distinct Processes of Motor Learning

Shancheng Bao, Texas A&M University; Aakash Srikanth, Texas A&M University; Emily Smith, Texas A&M University; Yuming Lei, Texas A&M University

Motor skill acquisition is considered to arise out of contributions from multiple learning processes, including error-based learning, use-dependent plasticity, and operant reinforcement. These different processes exhibit dissociable roles in motor learning. However, it remains largely unknown how a newly formed motor memory acquired through each learning process decays over time and whether distinct learning processes produce different generalization patterns. Here, we used variants of reaching paradigms that dissociated these learning processes to examine the time course of memory decay following each learning process (up to 24 hours) and generalization patterns of each learning process. We found that motor memories acquired through these learning processes decay with the passage of time. Notably, the memory of reinforcement learning was better preserved than that of error-based learning, while the memory developed through use-dependent learning faded away over a short period of time. Error-based and reinforcement learning achieved for a given movement direction generalized broadly to neighboring directions, with the generalization of error-based learning being more complete compared with that of reinforcement learning. In contrast, learning that occurred through use-dependent plasticity could not generalize to the untrained directions. These results suggest that distinct learning processes exhibit different patterns of memory preservation and generalization. Funding source: Not available.

Clinical Fall-Risk Assessments During and Following a 12-Week Attentional Focused Balance Training Program for Older Adults With Fall Risk

Amanda Barclift, University of North Carolina at Greensboro; Lauren Higgins, University of North Carolina at Greensboro; Ruth Stout, University of North Carolina at Greensboro; Jeff Labban, University of North Carolina at Greensboro; Jeffrey Fairbrother, University of Tennessee, Knoxville; Chris Rhea, University of North Carolina at Greensboro; Louisa Raisbeck, University of North Carolina at Greensboro

Thirty-six million falls are reported each year in older adults, making it a major public health concern. Falls are multi-factorial; thus, fall prevention interventions that incorporate both cognitive and physical factors is critical. The motor behavior literature has suggested that using an external focus (EF) of attentional focus has superior benefits for both performance and learning. This study investigated the effects of different attention focus cues during a balance training program in older adults with elevated fall risk. Seventy-nine older adults were randomly assigned to either an EF ($n = 31$, 80.7 ± 6.0 yrs), IF ($n = 26$, 80.5 ± 6.3 yrs), or control ($n = 22$, 74.3 ± 4.6 yrs) group. Participants completed a balance training program using wobble boards (20 minutes; 30s balance, 30s rest) twice weekly for 12 weeks. Prior to each trial, participants received attentional focus cues. Clinical fall-risk assessments (Functional Gait Assessment [FGA], Berg Balance Score [BBS], Time up and Go [TUG]) were assessed at baseline (Week 0), during (Week 6 & 12), and following (Week 13,16, and 20) the balance training program. The control group did not participate in the balance training program and only completed the clinical fall-risk assessments. A mixed ANOVA was performed to assess group differences across the 6 time-points. A significant between group effect was observed ($F = 7.97$, $p < .001$) between the control and EF group. Pairwise comparisons revealed significant differences between the two groups at all time points ($p < .05$), including baseline. Within group comparisons revealed no significant differences between time points and baseline for the control group. However, the EF group had significant increases in scores at W6 $t(30) = -2.55$, $p = 0.008$; W12 $t(30) = -3.13$, $p = 0.002$; W13 $t(30) = -2.83$, $p = 0.004$; $t(30) = -3.56$, $p < .001$; and W20 $t(29) = -4.02$, $p < 0.001$. These results suggest a benefit of EF on FGA from W6 of training that continued through W20 interval, two months after training ended. Funding: NIH National Institute on Aging, Grant #: 1R15AG053866 Funding source: NIH National Institute on Aging, Grant #: 1R15AG053866.

A Pilot Study Comparing Pitch-Throwing and Visual Pitch-Discrimination Practice for Improving Action- Prediction in Baseball Hitters

Zachary Besler, University of British Columbia; Georgia Grieve, University of British Columbia; Nicola Hodges, University of British Columbia

Both perceptual and motor experiences impact action prediction abilities, yet through potentially different mechanisms. Having physical experience with an action is thought to engage motor simulative processes, benefiting prediction. Here we ran a small-scale study to compare visual and motor training interventions for baseball pitch discrimination. Youth baseball athletes ($N = 20$, $M_{age} = 13.5$ yr, $SD = 0.5$ yr) completed a pre- and post-test, video temporal occlusion task, to assess predictions. They were randomly assigned to do either video (visual; $n = 11$) or pitch-grip (motor; $n = 9$) interventions. Both groups received three, 10 min training periods, over three weeks. For visual training, athletes watched videos of a pitcher throwing various pitches, from the hitter's perspective, and gave verbal pitch-type responses. Outcome feedback was provided. For motor training, athletes saw videos taken from behind the pitcher's mound of various pitches and then practised throwing with the various physical grips. Mean prediction accuracy (%) for each pitch type along with sensitivity scores for discriminating fastballs from changeups (d') were calculated. The youth athletes had high prediction accuracy and sensitivity in the pre-test, performing significantly better than chance at all occlusion points (ball release + 133 ms: $M = 72\%$; +266 ms: $M = 77\%$; +366 ms: $M = 72\%$; no occlusion: $M = 82\%$). Likely due to the high accuracy in the pre-test and the relatively short amount of practice time we had with the athletes, there were no increases in prediction accuracy from pre- to post-test. Unfortunately, we did not include a release-point occlusion condition where accuracy should be lower, forcing reliance on body cues. Anecdotally, the coaches and athletes were positive about the training. However, to better test the validity of such interventions, we need to a) have greater discriminability in our stimuli, b) implement any training for longer than 30 minutes and c) include no-training control comparisons. Funding source: NSERC (Discovery grant for NJH # RGPIN-2016-04269).

External Focus of Attention Facilitates the Central Processing and Muscle Activation

Mohammed Bila, Wayne State University; Mohammed Aljahni, Jazan University; Qin Lai, Wayne State University

Previous studies have well demonstrated that external focus of attention is associated with increased movement effectiveness compared to internal focus. The purpose of the current study was to utilize an innovative data acquisition system integrating Biopac instruments, E-Prime software, and a foot pedal to investigate the effects of attentional focus on fractionated reaction time (RT) and the electromyography (EMG). 12 male participants (age: 20-40) voluntarily signed an inform consent prior to the experiment. They were asked to sit a chair and used the right foot to depress a foot pedal by plantar flexion as fast as possible to respond a visual signal on the monitor. Participants were instructed to direct their focus on the foot pedal as the external attention and direct their focus on the foot movements as the internal attention, respectively. Each participant underwent a total of eight blocks (8 trials/block) including 4 blocks for external focus and 4 blocks for internal focus with counterbalance design. The surface EMG was recorded from the lateral Gastrocnemius (agonist) and the Tibialis Anterior (antagonist). The fractionated RT was acquired by analyzing the sEMG on the agonist. A 2 (Focus) x 4 (Block) ANOVA with repeated measures on the both factors found significant effects of attention focus in RT [$F(1, 11) = 39.50$, $p < .01$]), premotor time [$F(1,11) = 23.30$, $p < .01$], and EMG peak ($p < .05$). No differences were obtained in motor time and iEMG on focus of attention. Further, Tukey's SHS Test indicated that the external focus of attention produced faster RT, premotor time, and higher EMG peak relative to the internal focus. These findings suggest that external focus of attention facilitate the central information processing while internal focus of attention might inhibit the muscles efficiency.

Irregular Metronomes Alter Bimanual Coordination Dynamics

Kolby Brink, University of Nebraska-Omaha; Nick Stergiou, University of Nebraska-Omaha; Joel Sommerfeld, University of Nebraska-Omaha; Aaron Likens, University of Nebraska-Omaha

Coordination is the mastery of the redundant degrees of freedom of the body and has been described by two theoretical frameworks. These two frameworks are the Haken-Kelso-Bunz model, which is perhaps the most well studied model of rhythmic coordination and describes a basic law of coordination in and between biological movement systems and fractal geometry, which shows that human movement variability deviates, sometimes considerably, from simple random noise. There is, however, no satisfactory union of these approaches. The aim of this work was to bring together these theoretical perspectives. 15 healthy adults (M/F = 10/5, Mean Age = 25.2 ± 2.65 yrs) pronated and supinated their forearms in time with a metronome while seated with their arms situated at a 90° angle. The metronome was structured to either exhibit an invariant stimulus or a variability embedded stimulus (i.e., noise). Variability embedded stimuli consisted of three noise types: pink, white, and brown. The metronome increased mean frequency every 8 seconds until approximately 64 seconds (8 Epochs, total) had passed. Bimanual movements started with either an inphase (IP) or antiphase (AP) preparation. Mean relative phase (MRP) was computed from wrist rotation time series as the dependent measure of coordination. Multilevel models were fit to the data by sequentially adding the independent variables and performing likelihood ratio tests. The model with an interaction among noise, phase, and Epoch was the best fitting model for predicting MRP. MRP remained essentially constant during the IP conditions. MRP was also constant during Epochs 1-4 of the AP conditions. However, MRP during Epochs 5-7 of the AP conditions was significantly lower in pink noise as compared with all other conditions ($ps < .05$), signaling an earlier onset of a phase transition. Results suggest that entrainment to a metronome that exhibits pink noise variability elicits a phase transition sooner than other types of metronomes, indicating that fractal-like movement patterns seem to reorganize more quickly when perturbed. Funding source: This work was supported by GRACA-27182, NIH P20GM10909, NSF-2124918, and the Nebraska Collaborative Initiative.

Cognitive-Motor Interference in Elite Ice-Hockey Athletes

Mark Brinkbäumer, Goethe University Frankfurt; Christian Kupper, Goethe University Frankfurt; Karen Zentgraf, Goethe University Frankfurt

In recent times, cognitive-motor interference has gained attention as an indicator of sports expertise. The current literature suggests that team sport athletes, despite regularly being exposed to cognitive-motor interference scenarios on the court, show dual-task (DT) costs (DTC) when concurrently performing motor and cognitive tasks. The literature suggests that athletes with greater expertise show lower DTC in paradigms with higher specificity (Schaefer & Scornaienchi, 2020). To further the knowledge on the effect of specificity of the paradigm, this work investigates if DTC in a general (unspecific) DT paradigm (GP) can be predicted via three ice-hockey-specific DT paradigms (IHP). Forty-three ice hockey national squad players (17 f, 26 m; age 21.72 ± 4.23yrs) performed a 5 s standing tapping test as a motor single task (ST) and a number-speed-reading test as cognitive ST and both concurrently (DT) as GP. The IHP consisted of

motor-on-ice STs: a 30 m sprint and two multidirectional change of direction tests, which were paired with a cognitive task in DT conditions: 1) perception, memorization, recall of a color sequence (IHP1) 2) rapid perception and verbalization of a sequence of numbers (IHP2) 3) scanning four LEDs and quickly executing a shot at the correct light (IHP3). For all paradigms, motor DTC were calculated as ((DT-ST)/ST)*100). The relationship between GP and IHPs was assessed using multiple linear regression. A significant multiple regression of GP on IHPs was found ($R^2 = .26$, $F_{(3,31)} = 3.632$, $p = .024$). The sole individually significant predictor was IHP1 (beta = .431, $t_{(31)} = 2.69$, $p = .011$; other predictors $p > .20$). In addition, our results suggest that DTC in on-ice sprinting while processing visual sequences (IHP1) does explain some DTC variance in an unspecific tapping and number-speed-reading task (GP). IHP1 DTC is the major predictor, maybe due to the similar continuous cyclical nature of lower extremity movements. The sport-specific and performance-relevant combinations of motor and cognitive tasks should be a focus of future research. Funding source: Bundesinstitut für Sportwissenschaft (BISP).

The Effects of Auditory Cueing and Auditory Feedback on Motor Sequence Learning in an Implicit Serial Reaction Time Task

Elena Broeckelmann, University of Manitoba; Avery Sims, University of Manitoba; Steven Passmore, University of Manitoba; Cheryl Glazebrook, University of Manitoba

The practice of using sound to enhance both the learning and control of motor skills has recently gained interest in rehabilitation and sports contexts. One driving factor for this approach is the discovery of a cross-modal relationship in which the motor system is highly responsive to sound input. Movement studies interested in the effects of auditory stimulation have commonly administered auditory cues or auditory feedback only, and the effects may be task specific. For example, learning goal-directed movement sequences was found to be enhanced when auditory feedback was provided in the form of congruent tones, yet the effects of congruent auditory cues on motor sequence learning is unclear. It is unknown if auditory cues and auditory feedback facilitate motor sequence learning with the same processes, or to the same extent. To help provide insight into possible similarities or differences in auditory cues versus feedback during sequence learning, 24 neurotypical adults (18-35years; 15 cis-females; 9 cis-males) were assigned randomly to one of three practice groups: group 1 entrained their sequential target touches to a predetermined sound pattern (cues); group 2 produced the sound pattern in response to sequential target touches (feedback); and group 3 performed target touches with no sound (control). Retention and transfer tests (i.e., the same sequence in the other two sensory conditions), and an explicit awareness test, were conducted 48 hours after the practice session to assess for changes in Total Sequence Time (TST) and acquired/retained knowledge of the 10-item sequence order. A two-way mixed analysis of variance revealed significant main effects of time where TST decreased during acquisition, retention and transfer ($p \leq 0.05$). However, no effects for group or group-by-time interactions were identified. The explicit awareness test revealed that most participants (all but one) recalled less than 40% of the sequence order. Regardless of the sound condition, all groups acquired and retained equivalent implicit and explicit knowledge of the motor sequence. Funding source: NSERC.

Does Learning a Skill With the Expectation of Teaching it Impair the Skill's Execution Under Pressure if the Skill is Learned Implicitly?

Daniel Cabral, Auburn University; Marcos Daou, Coastal Carolina University; Juliana Parma, Auburn University; Mariane Bacelar, Auburn University; Will Holmes, Auburn University; Kaila Green, Auburn University; Daniel Morris, Auburn University; Josh Gann, Auburn University; Kate Messikomer, Auburn University; Will Franklin, Auburn University; Matthew Miller, Auburn University

Having learners practice a motor skill with the expectation of teaching it has been shown to enhance skill learning, but this benefit is lost when the skill is performed under psychological pressure. This choking effect is likely due to the large accrual of declarative knowledge about the learned skill, which is associated with reduced performance under pressure. Thus, we investigated whether this choking effect could be prevented if analogy instructions, which is expected to minimize the accrual of declarative knowledge, are employed. We used a 2 (Expectation: teach/test) x 2 (Instruction: analogy/explicit) x 2 (Posttest: high-pressure/ low-pressure) mixed-factor design, with repeated measures on the last factor. A total of 124 participants were quasi-randomly assigned (based on sex) to one of four groups. Participants in the teach/analogy and teach/explicit groups practiced golf putting with the expectation of teaching another participant how to putt, and analogy instructions or explicit instructions, respectively. Participants in the test/analogy and test/explicit groups practiced the same skill with the expectation of being tested on their putting, and analogy instructions or explicit instructions, respectively. The next day all participants completed low- and high-pressure putting posttests in a counterbalanced order, with their putting accuracy serving as the dependent variable. Results revealed that expecting to teach led to superior performance in the low-pressure condition, but only when explicit instructions were given. During the high-pressure condition, expecting to teach led to superior performance, but only for participants who had been given analogy instructions. In summary, results suggest the expecting to teach benefit is evident under high pressure if analogy instructions are used. However, these instructions eliminate the expecting to teach benefit under low pressure. In practice, we suggest learners train with the expectation of teaching and are given instructions dependent upon whether they will be required to perform under pressure.

Body Anthropometric Contributions to Learning a New Motor Skill

Ioana Andreea Campanu, Alexandru Ioan Cuza University; Delia-Elena Diaconasu, Alexandru Ioan Cuza University; Georgiana Juravle, Alexandru Ioan Cuza University

We present one study designed to assess whether specific body anthropometric characteristics predict the successful acquisition of a novel motor skill, as well as the time it takes to learn such a motor skill. For this, we recruited 51 participants (36 female, mean age: 25 years old, age range: 18 – 48 years old), all novice to using a weighted hula hoop. After a short demonstration on the technique by one experimenter, we gave each participant 3 trials with the hula hoop. We then instructed the participants that the goal is a continuous minute of hula hooping and timed each of their trials with a sports chronometer. The participants were required to perform 10 experimental hula hooping trials. They also underwent anthropometric assessment (e.g., weight, height, body mass index – BMI, fat/muscle mass percentage, bone mass, water percentage, together with metabolic age and a visceral fat index). Results highlight that 31.37% of participants were successful at continuously hula hooping for a minute. The learning time for the novel motor skill tested here is not influenced by specific body anthropometric features. However, by using a logistic approach, our data describe success in hula hooping as a function of gender, height, body fat percentage, the BMI, and the overall weight. Specifically, women are more successful at hula hooping, as well as taller people are significantly better with the motor task. Moreover, the higher the body fat percentage, the less hula hoop success is predicted. Importantly, with each kilogram of added body weight, the chance to successfully spin the hoop decreases by 8%. The results highlight the importance of body anthropometric properties in

the acquisition of a novel motor skill. We discuss these findings within the framework of theories motor skill acquisition and observed changes in behaviour. Funding source: This work is funded by a grant from the Romanian Ministry of Education and Research, CNCS-UEFISCDI, project number PN-III-P1-1.1-TE-2019-1699.

Context Modulates the Impact of Auditory Cues on Anticipation

Rouwen Cañal-Bruland, Friedrich Schiller University; Hauke S. Meyerhoff, Leibniz-Institut für Wissensmedien, Germany; Florian Müller, Friedrich Schiller University

Research on the impact of auditory cues on visual anticipation in tennis (e.g., Müller et al., 2019) suggests that the loudness of, for instance, racket-ball-contact systematically biases estimates of the power and/or speed generated by the contact, thereby influencing anticipatory judgments (Cañal-Bruland et al., 2018). In the current study, we ran two separate experiments that aimed at examining whether this impact of auditory cues on anticipatory judgments is dependent or independent of the sport-specific context. In Exp. 1, participants were invited to watch short video-clips of tennis rallies that stopped at racket-ball contact. Sounds of racket-ball contact were either present or muted. In two counterbalanced blocks, participants faced two different tasks: In block A, they had to indicate the ball's anticipated landing position by means of a mouse click; in block B, they had to estimate the ball's speed. The presence vs. absence of the sound of racket-ball contact was manipulated within participants. Results showed that participants estimated longer ball flight trajectories and higher ball speeds in the sound present condition than in the sound absent condition. To probe whether this effect is context-dependent or context-independent, in Exp. 2 participants (none of whom had taken part in Exp. 1) were invited to watch the same stimuli, however, this time without the sport-specific context being provided. That is, based on the original footage used in Exp. 1, we rendered new videos that only displayed the moving ball against an otherwise blank background (see also Goettker et al., 2021). In contrast to the results of Exp. 1, there was no impact of sound presence (vs. absence) on the anticipation on ball flight trajectories. However, similar to Exp. 1 participants judged ball speeds to be faster when sound was present compared to when it was absent. Together, these findings suggest that the impact of auditory information on anticipation does not seem to be a hard-wired, modality-specific effect, but to be moderated by context.

Making Strong Predictions: Testing Causal Hypotheses in Motor Behavior Studies

Michael J. Carter, McMaster University; Keith R. Lohse, Washington University School of Medicine; Matthew W. Miller, Auburn University

Many theories in motor learning (as in other areas of science) posit that experimental manipulations have a causal effect through a third "explanatory" variable. For instance, interleaved practice schedules are thought to have a beneficial effect on learning because the interference they create during practice engages cognitive processes that facilitate retention and transfer. Or, under OPTIMAL theory, providing learners with choice opportunities during practice has a beneficial effect on learning because it increases motivation. This relationship can be tested statistically through mediation models and generally be represented by the path model X→Z→Y; the experimental manipulation, X, affects the dependent variable, Y, through the explanatory variable, Z. In a cursory review, we examined 20 published papers, which detailed 21 independent experiments that were eligible for inclusion: 76% of which hypothesized an intermediary causal variable. Of those, all tested the effect of the practice manipulation on the dependent variable (X→Y, 100%; of which 81% were significant); sometimes tested the effect of the manipulation on an explanatory variable (X→Z, 47%; of which 75% were significant), but rarely tested any sort of path model/multivariable regression (X→Z→Y, 6%; of which none were significant). Additionally, we present three case-studies from the published literature showing how group-level mean differences (X→Y and X→Z alone) can be extremely misleading and how causal interpretations are not actually supported by the data. In sum, we argue that current experimental and analytical paradigms in the field provide researchers with too many degrees of freedom when looking for evidence to support a theory. We argue that theoretical predictions need to be stronger, ruling out more possible patterns of data. Limitations to this argument are discussed (e.g., it requires valid measures of X, Y, and Z). We hope that by challenging conventional research paradigms in motor behavior, we will foster productive debate and discussion for the field.

Availability of Adapted Recreation for Those With Mobility Impairments at Colleges and Universities

Judy Chandler, Central Michigan University; Brock McMullen, University of Wisconsin-La Crosse; Catherine Feirer, Grand Valley State University; Robby Carson, University of Wisconsin-La Crosse; Rick Ferkel, Central Michigan University

The study sought to determine adapted recreation opportunities and accessibility of recreation centers at 100 universities across the United States, stratified by size and location. Schools surveyed included 58 Division I schools, 24 Division II schools, and 18 Division III schools from all regions of the United States. Directors of Recreation at all included schools received an online survey that sought to determine the accessibility of their recreation facilities, adapted activities offered, and whether funding for Adapted Recreation was available. A response rate of 46% was obtain although not all questions were answered by a majority of participants. Universities with 5 total recreation facilities reported being ADA compliant and accessible. Universities with less than 5 facilities reported that they did not meet all compliance criteria in one or multiple areas. Accessibility was defined as all locker room and restroom areas had space for 360 degree wheelchair rotation, doors that were wide enough for mobility devices to navigate (i.e., at least 32 inches from door face to opposite stop), and power door assists. Twelve participants reported the adapted recreation activities they offered; wheelchair basketball, hockey, rugby, beep baseball, sit volleyball, goalball and unified flag football. Thirteen of the 46 responding schools indicated that there was funding for adapted recreation while 20 schools answered no, and 13 schools did not answer this question. Few respondents, 12 of 46, reported services for individuals with mobility impairments and had full wheelchair access within their recreation centers. Only 10 universities completed all questions on the survey. The findings in this study indicate that universities are lacking in programs, facilities, and funding to accommodate individuals with disabilities in recreational/physical activity pursuits.

Steps Synchronization to Unstructured Visual Cues Increases Metabolic Rate

Anaelle Charles, University of Nebraska at Omaha; Nicholas Stergiou, University of Nebraska at Omaha; Aaron Likens, University of Nebraska at Omaha

Walking exhibits natural variation over several gait cycle repetitions demonstrating long-range correlations (LRCs) over time (i.e., pink noise). Those natural patterns are associated with healthy, optimal, and adaptative movement and their deterioration is associated with disease; consistent with the Optimal Movement Variability Hypothesis (OMVH). To restore healthy variations, previous studies have suggested synchronizing steps with variable cues exhibiting LRCs. However, the influence of walking with such cues on the metabolic cost of walking remains unclear. This study investigated the

effect of synchronizing steps to various visual cues on metabolic cost of walking. Participants walked four 12-minute trials wearing footswitches on both heels while the COSMED K5 recorded metabolic rate. Participants completed a self-paced trial to determine mean and standard deviation to scale visual cues for the 3 remaining trials where visual cueing was implemented. Then, participants were instructed to synchronize their right heel with a signal displayed on augmented reality glasses. Participants walked under 3 visual conditions: pink noise, invariant (traditional metronome), and white noise cueing. The order of conditions was randomized. Strides were analyzed using Detrended Fluctuation Analysis to compute the scaling exponent α, a measure of statistical persistence. Linear mixed-effect models were used to examine noise and α on walking metabolic cost. The analysis showed that pink noise produced the smallest elevation when compared to the other conditions. A negative relationship between α and metabolic cost was found such that higher α predicted lower metabolic cost. These findings suggested that synchronizing steps to pink noise reduces metabolic cost compared to invariant and white noise visual cues. These results support the OMVH, demonstrating that healthy movement exhibits long-range correlation overtime (pink noise). Moreover, these results demonstrate that optimal forms of movement variability promote more efficient locomotion. Funding: P20GM109090, NSF-2124918 Funding source: P20GM109090, NSF-2124918.

The Reliability of Center of Pressure Visual Feedback on Postural Control in Young Adults

Kuanting Chen, Texas Christian University; Adam King, Texas Christian University

The purposes of this study were to (1) evaluate the intrasession reliability of the center of pressure (COP) measures with the presence and absence of visual feedback during static and dynamic balance tasks and (2) examine the effect of visual feedback on upright standing postural control strategy. Nine healthy young adults performed five 30-second trials of four conditions (static standing without visual feedback, static standing with visual feedback, dynamic standing without visual feedback, and dynamic standing with visual feedback) in a randomized order. Visual feedback was presented as two different color lines representing anterior-posterior (AP) and medial-lateral (ML) COP position. In the dynamic condition, participants were asked to move as much as possible while keeping their feet on the ground and maintaining gaze at the feedback signals or a fixed (no feedback) object. A force plate recorded the COP trajectories in the AP and ML directions. Intraclass Correlation Coefficients (ICCs) were calculated for COParea, and alpha values of detrended fluctuation analysis (DFA-AP and DFA-ML). Multiple 3-way (task, feedback, trials) repeated measure ANOVAs were performed on all COP variables to examine the effect of feedback and any potential learning effects occurring over trials. The ICCs for dynamic conditions (0.942-0.994) were higher than static conditions (0.779-0.966). The ICCs for trials with feedback (0.779-0.978) were less than the trials without feedback (0.875-0.994). Repeated measure ANOVAs revealed that DFA-ML was significantly lower in the absence of feedback ($p = .044$). A significant task and trial interaction was found in DFA-ML ($P = 0.003$) with the dynamic task showing a decreasing trend in DFA over trials while an increase in DFA occurred for the static task. Overall, good to excellent reliability was found for all conditions indicating that postural control strategies remained similar across trials. Interestingly, the structure of the COP trajectory in the ML, but not in AP, direction was influenced by the task and the presence of feedback.

The Effect of Choice on Practice Limb Does Not Influence Bilateral Transfer

Sean M. Cochran, New Mexico State University; Christopher A. Aiken, New Mexico State University

Control over an aspect of the practice environment has been shown to facilitate learning of a variety of skills (Wulf, 2007). Choice, or autonomy, creates feelings of competence supporting the psychological need for learning (Sanli et al., 2013). One area unexplored is the effect of control within bilateral transfer (BT). BT is when practice with one limb has positive effects on the contralateral limb. Understanding manipulations that positively affect BT potentially influences how practitioners instruct when BT is an important aspect of the skill. 46 right-handed participants were included in the study. Participants completed a pre-test which consisted of 3-trials of the Purdue Pegboard task with both the dominant and non-dominant limb. The goal of each 30 second trial was to place as many pins as possible. Participants were then semi-randomly assigned to a choice group, where they chose the practice limb, or a control group where the practice limb was pre-determined. During practice participants completed 21 trials of the pegboard task with their chosen or assigned limb. Post-testing was administered 10 minutes following practice which was completed in the same manner as pre-testing. The number of correctly placed pegs was analyzed with 2 (group) x 2 (practice limb) x 2 (test: pre to post) ANOVAs for the dominant and non-dominant limb. Results revealed a significant main effect for test ($p < .001$) with groups improving from pre to post. No group differences were observed. Amount of BT change scores were calculated and analyzed through independent *t*-tests. BT was observed in both directions ($p < .05$) with no difference between amount of transfer from the dominant to non-dominant limb, or vice versa. Similar to previous research we observed positive BT between both limbs, however, we failed to find an effect of autonomy on transfer of learning. One potential explanation for this finding is that providing control over a task-irrelevant feature, as opposed to task-relevant, was not enough to observe the benefits typically reported in the literature.

Eye-Hand Coordination in 9-Months-Old Infants: A Process Still in Progress as Revealed By a Selection Task

John P. Connell, University of Tennessee; Daniela Corbetta, University of Tennessee

Nine-month-old infants are relatively good at reaching. As a result, they are assumed to rely on vision to plan and execute their goal-directed actions. However, no studies have assessed how infants use vision during the reach. This study aims to identify infants' looking and movement patterns during the reach to capture how eye-hand coordination unfolds. We also used larger objects as targets than typically used to investigate action selection. Twenty-one 9-months-old infants were presented with 18 cm long objects (rods, drumsticks, and dumbbells). Fixations and reaching kinematics were recorded using eye-tracking and motion tracking sampling at 120Hz. Fixations were identified across 3 areas of interest: the left, right, or middle of the object. Kinematics were used to extract the number of movement units, percent of reach at max velocity, and duration. Three coordination strategies were identified: A targeted strategy where infants fixated on one object area prior to reaching, maintained that area of fixation, and contacted there; an untargeted strategy where the location of fixations and contact never matched during the reach; and a catch-up strategy in which infants looked elsewhere when they initiated their reach but then shifted their fixations to the contact point prior to contact. Infants used untargeted strategies 60% of the time compared to 21% and 19% for targeted and catch-up strategies ($p <.001$). The catch-up strategy was more often employed when reaching for the drumstick (23.13%) compared to the rod (19.76%) or dumbbell (18.33%, $p < .05$). Kinematics revealed that catch-up reaches took longer ($p = .014$) and contained more movement units than untargeted reaches ($p = .014$). Finally, targeted reaches achieved higher reach velocities than untargeted reaches ($p = .009$). These findings show that infants mostly did not reach where they looked or made corrections during the reach resulting in longer trajectories. Visual

selection of a location prior to reaching was mostly missing, indicating that visuo-manual coordination is still forming in 9-month-olds.

Controlling Countermovement Jump Landings Following Dynamic or Foam-Rolling Warm-Ups

D. Clark Dickin, Ball State University; Rachel McCormick, Ball State University; Henry Wang, Ball State University; Dorice Hankemeier, Ball State University

Dynamic warm-ups (DWU) are commonly used to prepare the body for physical exertion, while foam rolling (FR) has been traditionally used as a form of myofascial release. Recently studies have explored using FR as an alternative warm-up technique given its ability to warm muscles and improve mobility, but its influence on muscle function during dynamic actions, including landing maneuvers and injury risk is lesser known. Thus, the purpose of this study was to assess flexibility and landing mechanics between DWU and FR warm-ups in athletes performing maximum countermovement jumps (CMJ). Twelve female participants (19.33±1.22 years; 1.65±0.05 m; 66.04±8.51 kg) performed 3-maximal CMJ's prior to, and following each warm-up intervention, on separate days. Motion capture and force data were used to calculate joint motion and loading during CMJ landings while static flexibility was assessed using the sit-and-reach test and Modified Thomas test. Flexibility data were analyzed using paired t-tests while kinematic and kinetic data were analyzed using separate 2×2 RM-ANOVAs (time x warm-up). Study results demonstrated improved flexibility on both measures of flexibility for the DWU ($p \leq 0.025$) but only on the Modified Thomas Test ($p = 0.023$) for the FR warm-up. Significantly lower loading rates ($p = 0.041$) were revealed for the FR warm-up technique (18.83±6.87 vs. 21.36±8.44 Body Weights/second), in addition to a significant interaction for peak knee abduction angle ($p = 0.04$: ~12% reduction for DWU vs. ~15% increase for FR). Additionally, several measures associated with reduced ACL injury risk were improved for both warm-up techniques with small to moderate effect sizes. Most notably FR reduced peak ground reaction force, increased knee and hip angle at impact and reduced knee external rotation. Importantly, both warm-up methods were attributed with both reductions and increases in measures associated with ACL injury risk. While the DWU is widely accepted and used, alternative warm-ups, like FR, may be adopted to help prepare female athletes for dynamic activities like landings.

Changes in Golf Swing Learning Training Using Positive or Negative Self-Control Feedback

Lee Dong-Youn, Seoul National University

Background: Through previous studies, self-controlled feedback is recognized as a more efficient feedback method than the existing feedback provision method. The golf swing is a high-level technique that consists of complex and continuous movements that use various muscles and joints of the body. During exercise, feedback plays a very important role in detecting and correcting errors in motion, or in motivating and performing appropriate coordinated motions through reinforcement information. The purpose of this study was to evaluate which self-controlled feedback information Positive Feedback (PF) or Negative Feedback (NF) is better for golf skill learning on learning curves.Methods: 15 participants (12 male, 3 female) handicap(18±2.5) were randomized into 2 groups(PF, NF). Participants performed 20 swings with a 7 iron in 1 trial (20 swings for pretest, 3 days for practice, 20 swings for post-test). After practice 1 day later post-test was performed. Both PF, NF group participants were provided feedback in line with the group purpose. Positive or Negative feedback guideline data were collected through experts measurements. Experts were professional golfer for more than 10 years and holds several related certifications. Using Skytrak (Gpro co,. Ltd) X-swing program as a measurement to offer ball flight results. Results: Our study showed better performance and improvement in golf swing pattern both PF and NF groups. The NF group showed better coordination levels and outcomes faster than the PF group after receiving feedback. The PF group showed higher consistency than the NF group than the correction of the swing. Both group swing pattern and results showed gradual improvement in 3 days and post-test. Conclusions: Both positive and negative self-controlled feedback improves golf swing performance and learning. Negative self-controlled feedback had an advantage in showing a faster swing learning rate and correction. Positive self-controlled feedback showed better swing consistency than the negative self-controlled feedback group.

Open and Closed-Loop Motor Control: Do They Both Exist in a Single Motor Action?

Scott W. Ducharme, California State University, Long Beach; Will W. Wu, California State University, Long Beach; James R. Becker, Montana State University

Motor actions are often parsed into two general control process categories; open loop control for discrete, short duration motor actions, and closed loop control for continuous, longer-duration motor actions. Closed loop control includes using sensory feedback to modify the action while it's occurring. The standing long jump (SLJ) is considered a motor action under open loop control because it is a brief, power-based action. However, this categorization may be an oversimplification, as different aspects of the SLJ may utilize varying levels of sensory feedback and thus different types of control. The purpose of this study was to investigate the control processes that underlie the SLJ by assessing coordination variability (CV). Twelve healthy young adults (age 21.4 ± 1.1 yr; height 1.71 ± 0.19 m) performed 10 SLJ trials, attempting to jump as far horizontally as possible in a single jump. The motion was parsed into a: 1) downward phase (from the start of descent to peak knee flexion) and 2) takeoff phase (from peak knee flexion to toe off). Knee-Hip (KH) and Knee-Ankle (KA) coordination was defined as the sagittal plane coupling angle between the two joints and obtained using a modified vector coding technique. CV was quantified as the standard deviation (via circular statistics) across trials for each percentage (0-100%) of a given phase, and then averaged across all percentages for each participant. A within-subject analysis of variance revealed a main effect of both phase ($F_{(1,11)}$= 16.66, p = .002) and coordination pattern ($F_{(1,11)}$= 9.02, p = .012). The downward phase (CV=26.8±9.8 and 27.1±11.3 degrees for the KH and KA, respectively) displayed greater coordination variability compared to the takeoff phase (CV=10.3±6.7 and 14.0±7.5 degrees for the KH and KA, respectively). The larger magnitude CV in the downward phase suggests use of sensory feedback and error corrections. Thus, these findings suggest that the SLJ is controlled by a closed-loop process in the downward phase and an open-loop process during the takeoff phase.

Reinforcement Learning in Motor Skill Acquisition: Using a Psychophysiological Measure to Understand the Mechanisms Underlying Behavior Adaptation

Mariane F. B. Bacelar, Auburn University; Keith Lohse, Washington University; Matthew W. Miller, Auburn University

Reinforcement learning (RL) theory is an important model to understand motor skill acquisition and claims that humans make behavior adaptations based on errors to maximize rewards. Specifically, RL theory posits that better-than-expected outcomes are more rewarding and should thus be maximized during practice. Despite RL theory's prominence, few studies have tested its predictions in a motor learning context and fewer have tried

to uncover mechanisms underlying the predictions. Thus, we had 134 participants perform a nondominant arm beanbag tossing task and recorded their performance as well as reward-related electroencephalographic (EEG) responses to feedback about trial outcomes, quantified as the amplitude of the EEG component reward positivity (RewP). We used mixed-effects models to investigate: (1) the relationship between performance and RewP and whether that depended on participants' average performance; (2) whether RewP predicted trial-to-trial performance adjustments during acquisition in accordance with RL theory; and (3) whether RewP predicted post-test performance. Results showed that more accurate throws were associated with more positive RewPs, as predicted by RL theory. However, contrary to past findings, participants' average performance did not moderate the relationship between performance and RewP. Regarding the second aim, as predicted by RL theory, RewP was implicated in trial-to-trial performance adjustments, but this relationship was part of a complicated interaction with phase of practice. Specifically, results showed that early in practice, larger RewPs were associated with larger adjustments in performance, and this relationship reversed later in practice. Finally, RewP did not predict learning as indexed by performance on post-test, as would have been predicted by RL theory. Together, these findings highlight the complex relationships between feedback processing and behavior and the need for future investigations to better understand the extent to which RL principles may be used to explain short- and long-term behavior adaptation.

An Assessment of Instructional Methods, Student Perceptions, and Skill Acquisition in a Collegiate Beginner Hapkido Class

Kevin Fisher, Central Michigan University

Regular exercise in the form of martial arts is a viable method of promoting positive physical and psychosocial outcomes for practitioners worldwide. While certain styles are popular in many countries around the world, the Korean art of Hapkido has seen limited scientific examination in academic research. The goals of this study were to evaluate potential benefits of completing a beginner collegiate Hapkido physical education course, critically examine student perceptions of instructional methods and practice structure, and determine the extent to which students were able to acquire basic techniques. In a pretest-posttest design, students ($n = 36$) were surveyed about intrinsic characteristics and perceptions of instruction and evaluated on acquired skills. Results indicated a significant increase in self-perceptions of knowledge ($p < .001$) and interest ($p = .029$) in Hapkido along with interest in martial arts ($p = .008$) and areas such as self-perceived athletic ability ($p = .007$), fitness ($p = .015$), self-defense capability ($p < .001$), and self-defense confidence ($p = .001$). Instructional strategies included verbal explanations with an emphasis on physical demonstrations, and a blocked practice style was utilized in conjunction with both reinforcing and corrective feedback. A majority of students reported an attentional focus on the correct steps or body positioning related to each technique, rather than proper movement outcome, suggesting that internal foci were encouraged. Skills testing conducted by four independent raters revealed that students scored an average of 83% on the posttest, suggesting substantial progress over the 16-week period. These findings substantiate claims that physical education activity courses can be effective at increasing knowledge and skills that may contribute to success along with an inclination for future involvement. In addition, pedagogical strengths and weaknesses are elucidated and discussed.

Exploring Cognitive Load Within a Contextual Interference Paradigm

Nancy Getchell, University of Delaware; Patricia Shewokis, Drexel University

Contextual interference (CI) occurs when learners presented with multiple tasks in a non-repetitive order (RND) perform better on retention/transfer than those presented in a repetitive (BLK) order. High CI settings require large amounts of cognitive effort; however, research has focused on measuring behavioral outcomes rather than directly investigating brain activity and its relationship to performance. We examined novel ways to investigate cognitive load in a CI paradigm using functional near infrared spectroscopy: Relative neural efficiency (RNE), relative neural involvement (RNI), and laterality index (LI). RNE integrates measures of cognitive effort and behavioral performance; in high CI learning environments, RNE should initially be poor (high cognitive effort, low behavioral performance), then improve during retention and transfer. RNI measures the relationship among motivation, mental effort, and performance. LI allows for the exploration of lateralization between the cerebral cortex hemispheres. We reanalyzed existing CI data to explore RNE, RNI, and LI during transfer to demonstrate their usefulness in understanding the effects of CI on cognitive load (Shewokis et al, 2017). The primary dependent measures were mean global score (aggregated proficiency score in a virtual, simulated surgical coordination task) and mean peak total hemoglobin of the right and left prefrontal cortices (PFC) using a 16-channel continuous wave optical imaging system (fNIR Devices, LLC). We found significant differences in RNE between BLK and RND in the right and left PFCs ($p<.05$) indicating that RND was more efficient at problem solving during transfer than BLK. RNI did not differ. Although there were no differences in the LI, the right PFC approached significance ($p = .051$) indicating BLK had more activation than RND in the right PFC during performance of the coordination transfer task. This increased activation contributes to the RNE differences in cognitive load. We discuss how these measures can be used to better understand cognitive learning processes.

Unique Role of Post-Stroke Fatigue in Reach Performance and Arm Use After Stroke

Hui-Ting Goh, Texas Woman's University; Jill Stewart, University of South Carolina; Kevin Becker, Texas Woman's University

Impaired reach performance and reduced affected arm use after stroke are often attributed to motor impairment. However, many individuals with stroke also experience significant post-stroke fatigue (PSF), defined as intensified perceived effort during activities. It is unclear whether PSF influences reach performance and arm use after stroke. The purpose of this study was to examine the impact of PSF in reach performance, perceived effort during reaching, and arm use in individuals with chronic stroke. Thirty-two participants (6 females, mean age = 55.5 years, mean chronicity = 60 months) performed a 2-dimensional reaching task with the affected arm. Reach performance was quantified by reaction time, movement time and endpoint accuracy. Perceived effort during reaching was assessed using the Borg Rate of Perceived Exertion (RPE). Arm use was assessed using the Motor Activity Log (MAL). The Fatigue Severity Scale (FSS) and Fugl-Meyer Upper Extremity (FMUE) scale were used to measure PSF and motor impairment, respectively. Correlational analyses revealed that FSS was significantly correlated with movement time ($r = 0.47$, $p = .01$) and reaction time ($r = 0.36$, $p = .04$), but not with the endpoint accuracy ($r = 0.28$, $p > .05$). FSS was also significantly correlated with the differences in movement time between self-selected and fast reaches ($r = 0.42$, $p = .02$). Both MAL ($r = -0.37$, $p = .04$) and Borg RPE ($r = 0.52$, $p < .01$) significantly correlated with the FSS. Stepwise regression analyses with both FSS and FMUE as potential predictors showed that FSS but not FMUE significantly predicted reaction time ($R^2 = 0.13$; $p = .04$), the movement time differences between self-selected and fast reaches ($R^2 = 0.17$; $p = .02$), and RPE ($R^2 = 0.27$; $p < .01$). In contrast, FMUE but not FSS significantly predicted movement time ($R^2 = 0.23$; $p = .01$) and MAL ($R^2 = 0.60$; $p < .01$). Our findings suggested that PSF might explain

reach control deficits that are not accounted for by motor impairment and should be considered in future studies on upper extremity control after stroke. Funding source: Texas Woman's University Research Enhancement Program.

Dynamical Action Costs Modulate Concurrent Decision-Making

Eric Grießbach, Friedrich Schiller University; Philipp Raßbach, Julius-Maximilians-Universität; Oliver Herbort, Julius-Maximilians-Universität; Rouwen Cañal-Bruland, Friedrich Schiller University

Concurrent movements (CM) have been shown to influence decision-making (DM) (for an overview, see Gordon et al., 2021). For instance, during walking humans preferably make decisions that align with a turn towards the side of their current swing leg (Griessbach, Incagli, Herbort, & Cañal-Bruland, 2021). It is assumed that CM influences DM by coincidental changes in motor costs. If true, systematic manipulations of motor costs should be reflected in changed decisions. During walking the stability of turning changes with the swing leg. A turn towards the side of the swing leg enables a lateral step and a turn towards the opposite side requires a less stable cross-over step. The difference in stability between the stepping strategies is moderated by the turning angle. Therefore, we expected that the turning angle should also moderate the swing leg effect. To test this, participants had to walk towards a central obstacle and then bypass it to collect rewards displayed for a left or right target (Y-fork). Reward options for two lateral targets were displayed one step before reaching the obstacle. The swing leg before bypassing the obstacle was manipulated by predetermining the starting position (left or right foot in front). The angle between targets varied symmetrically (15°, 52.5°, or 90° left/right). Results showed that the swing leg influenced participants' decisions, replicating prior results (Griessbach et al., 2021). Specifically, participants were biased to walk toward the side of the swing leg, even at the expense of receiving less reward. The target angle did not moderate the swing leg effect. However, additional analyses revealed that with higher target angles participants increasingly replaced cross-over steps with transition steps (positioning both feet next to each other), probably to compensate for decreases in stability of cross-over steps. Together, our findings seem to suggest that anticipated motor cost differences can be compensated for by strategic choices and adaptation of subsequent motor behavior. Funding source: German Research Foundation (DFG) CA 635/4-1.

Assessing the Reliability and Validity of Online Tasks to Assess Perceptual Cognitive Skills in Baseball

Georgia R Grieve, University of British Columbia; Zachary Besler, University of British Columbia; Sean Muller, Federation University; Nicola J Hodges, University of British Columbia

There has been an increasing interest in the commercial training of perceptual skills in sports, particularly in baseball (e.g., baseball pitch recognition). However, there is little empirical evidence as to the effectiveness of online training apps, nor research into pitch recognition skills in players across different ages and experience. In response to these questions, we launched an online study to collect data from baseball players of different ages and experience with respect to pitch discrimination, as well as to validate online with in-person measures. To date, we only have data from $n = 21$ players, mostly playing varsity-level baseball ($M_{age} = 18.1$ yr, range = 13 – 21; $n = 7 < 17$ yr). All individuals were at a high level of skill for their age. In addition to a temporal occlusion task to assess pitch discrimination, we also assessed dynamic visual acuity (DVA) (Landholt C). A small subset of individuals completed both an online and in-person assessment ($n = 6$). Although our power is limited to detect differences, there was no indication of prediction accuracy or sensitivity differences as a function of age. Fastballs were better detected than change-ups and curve balls. There were differences between our two test-stimuli pitchers, with accuracy being ~50% for one pitcher (with high false-alarms for change-ups vs. fastballs) and closer to ~70% for the second pitcher. Inter-item reliability (each clip was shown twice), based on % agreement, was ~70% for fastballs and changeups, but lower for curveballs. Inter-item reliability was 62% across the online and in-person tasks, showing only moderate reliability. We are currently collecting data from a low-skill/inexperienced sample of athletes, to better assess task validity and through analysis of the Landholt C task, will assess relationships between domain specific and general measures of perceptual skill. Recruitment of younger children was difficult, although we plan to relaunch attempts, once we have established good reliability and validity of the test films. Funding: NSERC Discovery grant for NJH # RGPIN-2016-04269.

Fissures and Flaws in the Foundations of Fitts Law: The Movement Speed-Accuracy Trade-Off in Context

Peter Hancock, University of Central Florida; Karl Newell, University of Georgia; Gabriella Hancock, California State University, Long Beach

Assuredly, the most famous law of movement control bears the name of Paul Fitts. His seminal 1954 work sought to determine the information capacity of the motor system which was subsequently formalized into the famous equation $MT=a+b\log_2(2A/W)$ in work alongside Peterson a decade later. The equation's apparent ubiquity and expressional elegance led to its contemporary acceptance as a founding block of all motor control. Here, we cast a critical eye over this edifice, partly for the purposes of theoretical re-evaluation and partly from a pragmatic perspective due to Fitts equation's wide use in technology design. Our criticisms range from general concerns, e.g., Fitts equation only applies to movements close to extremes of speed and accuracy and therefore fails to comprehend the vast majority of voluntary movement, to specific disputes internal to the equation, e.g., the non-zero intercept value (a) only derives from the artificial way in which the specific aiming task was used in the original work. We also note that the quantitative value of the equation's slope (b) is impacted by the arbitrary log base choice which Fitts used to justified associations with Information Theory. We acknowledge the corpus of recent reports that also feature critiques of Fitts formulation. Here we expand our evaluation to consider how inter- and intra-individual differences, that support the law only by cross-individual, cross-trial aggregation, impact the theoretical and practical application of all such Law of behavior. As a scientific principle, we must reserve our greatest doubts for our most cherished beliefs. Our purpose in the greater, elaborative presentation is to explore and explicate many of Fitts-specific concerns as well as others pertinent to the whole genre concerning the nominal trade of speed for accuracy in human movement achievement.

The Relationship Between Attentional Focus and Racewalking Gait

Aleiza Higgins, University of North Carolina-Greensboro; Louisa Raisbeck, University of North Carolina-Greensboro

Racewalking literature is limited and lacks substantial application of motor learning theories. This sport requires specific rules of movement: (1) the knee must be straight when the heel contacts the ground, not bending until the body has passed over it and (2) there must be one foot in contact with the ground at all times. To ensure this, judges are placed around the track to give warning paddles to individuals "breaking form" with the goal of returning competitors' attention to their gait mechanics, implying the use of an internal attentional focus rather than an external one. It has been suggested racewalkers may benefit from certain internal attentional focus cues but this was not in a race context and did not look at the effect of

judging. This use of an internal focus in this case may be supported by the attentional focus literature given the rational for why an external focus is typically better. Previous research has demonstrated that an external focus of attention has a greater improvement in performance compared to an internal focus of attention. The constrained action hypothesis suggests that an internal focus of attention may constrain or interfere with automatic processes rather than allowing the motor system to self-organize. The argument could be made that racewalking is a continuous constrained action task as the goal is not just to get from point A to point B as quickly as possible, but to do so in a very specific, constrained way with real time judging to ensure this. Thus, the constrained action hypothesis would still be valid, but in this case serve as a rationale for the use of an internal focus for racewalking. Based on this, the proposed study would have 3 aims: (1) determine the type of attentional focus reportedly used most often by racewalkers, (2) determine if an internal focus is specifically used when passing judges, and (3) determine if the racewalk gait mechanics change when passing a judge. These findings would contribute to refinement of the attentional focus literature as well as racewalk literature.

Preliminary Associations Between Heart Rate Variability and Fall Risk

Lauren Q Higgins, University of North Carolina Greensboro; Jeffrey D Labban, University of North Carolina Greensboro; Christopher K Rhea, University of North Carolina Greensboro; Laurie Wideman, University of North Carolina Greensboro; Louisa D Raisbeck, University of North Carolina Greensboro

Early detection of fall risk (e.g., likelihood of sustaining a fall) is critical for the prevention of fall related disability in the older adult population. Current methods for assessing fall risk are primarily unidimensional and measured in a controlled environment (e.g., clinical setting); however, fall risk is multifactorial and falls occur in the dynamic, free-living environment. As a result of these methodological limitations, many injurious falls occur prior to the detection of elevated risk, nullifying the opportunity for preventative interventions. Wearable sensor technology provides one prospect to fill these gaps in fall risk identification by measuring underlying physiological factors, such as heart rate variability (HRV). Importantly, age-related loss of physiological variability is associated with an inability to respond and adapt to physical perturbations, which can increase fall risk. HRV is as a marker of physiological variability; however, the efficacy of HRV to predict fall risk in healthy, community dwelling older adults remains unknown. Therefore, our goal was to examine associations between HRV and fall risk in community dwelling older adults ($M_{age} = 74.45 \pm 5.46$years). Participants were separated into groups based on self-report of a fall during the previous 12 months ($n = 11$ Fallers, and $n = 18$ Non-Fallers). HRV was collected in participant's free-living environment for 24 hours via a heart monitor chest strap integrated with a wrist worn accelerometer. HRV was measured as the standard deviation of the normal-to-normal intervals (SDNN). A small effect of fall risk category on SDNN was observed, with fallers ($M = 24.66 \pm 11.71$) demonstrating smaller SDNN compared to non-fallers ($M = 31.63 \pm 24.21$; Hedge's g = 0.33, 95% CI [-0.44, 1.10]). These preliminary data suggest that lower HRV measured over 24-hour may be associated with elevated fall risk in older adults. Thus, while further research is needed, HRV measured via wearable sensors would provide a cost-effective and time efficient method for assessing fall risk in the free-living environment.

Association Between Online Motor-Cognitive Game Performance and APOE e4 Carrier Status Among Older Adult Mindcrowd Users

Andrew Hooyman, Arizona State University; Matt Huentelman, Translational Genomics Research Institute; Sydney Schaefer, Arizona State University

A major challenge in pre-clinical Alzheimer's Disease (AD) clinical trials is identifying individuals who are most likely to develop AD or experience significant cognitive decline during the trial period. Because people who are carriers of the APOE e4 gene are at higher risk of experiencing cognitive decline and dementia than non-carriers, APOE genotyping is commonly used as a screening or 'enrichment' tool for AD clinical trial enrollment. Emerging evidence from our laboratory suggests that motor behavior may provide unique insight into the progression of AD, which could serve as a low-cost biomarker. Thus, the purpose of this study was to examine if performance on a web-based motor-cognitive game (Super G) is associated with APOE e4 carrier status. The goal of the Super G game is to transport an astronaut avatar (in two dimensions) from a start planet to a goal planet using the arrow keys on a computer keyboard in 4.5 seconds or less. This study is in collaboration with MindCrowd, an online initiative aimed at recruiting one million people as part of an AD research repository. We emailed 662 older adults whose APOE e4 carrier status is banked within the MindCrowd repository a link to the Super G website requesting them to play a minimum of 75 trials (equaling ~5.6 minutes of play time). Overall, 58 participants (APOE e4 carrier = 23) completed the Super G task (mean age = 56.8 ± 7.7; 42 females). Data showed that Super G performance (measured as the time at which the astronaut leaves the start planet, i.e., response time) significantly predicted APOE e4 carrier status ($p = .014$) while controlling for age, cognition, sex, and education. Interestingly, APOE e4 carriers demonstrated better response time than non-carriers. This is consistent with recent research demonstrating an APOE-e4 advantage on a visual working memory task, relative to non-e4 carriers. In conclusion, results of this study suggest that performance on the web-based Super G task could be an alternative screening or enrichment tool for AD clinical trial recruitment. Funding source: National Institutes of Health, F32AG071110.

Attentional Focus Effects on Movement Variability in a Virtual Reality Reaching Task

Charlend K Howard, Louisiana State University; Arend Van Gemmert, Louisiana State University; Nikita A Kuznetsov, University of Cincinnati

Subtle changes in task instructions with associated changes of one's focus of attention (AF) can have measurable effects on performance and learning of complex motor skills (Wulf, 2013). The beneficial effects of adopting an external focus of attention (EF) have been well-documented in physical environments and recently have also been demonstrated in virtual reality (VR) environments (Cochran, Aiken, Rhea, & Raisbeck, 2021; Yamada, Kuznetsov, Diekfuss, & Raisbeck, 2021). Healthy young adults (N = 6) performed a planar reach-to-grasp movement with a physical dowel represented in a virtual reality environment. Subjects performed reaches with their dominant hand (R) as quickly as possible where the virtual endpoint would disappear and only reappear once the subject had stopped moving their arm (terminal feedback) under three different instructions: no-focus (NF), EF, and internal focus of attention (IF). Joint angles of the clavicle-scapula, shoulder, elbow, and wrist were recorded, and their covariation for controlling dowel endpoint was analyzed using the uncontrolled manifold analysis (UCM). Analysis of this preliminary sample of participants showed EF to have better endpoint accuracy measures (MRE, SRE) than NF, but no difference in endpoint accuracy measures when compared to IF. Results for the UCM measures (Vucm and Vort) showed no difference in coordination patterns across conditions. These results indicate that AF and VR does not change the coordination pattern of the subjects. In contrast to previous studies, EF did not lead to large performance changes when compared to IF. These findings are preliminary, because they are based upon a small sample; possibly the full sample (N = 40) may expose a small effect of AF and VR on the coordination patterns during the reach in this study.

Effects of Precision Training on Aiming Stability: An Ecological Approach

Chia-Sheng Huang, National Taiwan Normal University; Chih-Mei Yang, National Taiwan Normal University; Chang-Chih Shih, National Taiwan Normal University; Jui-Hsi Hung, National Taiwan Normal University

Postural stability plays an important role in precision sports such as archery and shooting. Athletes have to control posture finely to achieve excellent performance in competitions. Previous research suggested that body sway enhanced the perception of external information that isn't just the noise in motor control mechanism. This study was designed to examine effects of body sway, fluctuation of aiming, and the trace of aiming point experts and novices in different precision sports with task. Thirty-nine (seven archery experts, sixteen police school shooters, and sixteen healthy adults) were recruited to perform the aiming task in two standing positions. The six-degree magnetic tracking system was used to measure body sway and the fluctuation of the laser pointer during aiming task. We found the correlations among the three dependent variables were affected by the type of the participants and the aiming postures. In aiming performance, shooters performed better than healthy adults. The standing posture difference was found in the group of shooters, they had better aiming accuracy with lateral standing posture. Besides, the analysis of body sway showed interaction of the participant type and aiming posture in antero-posterior direction and only condition main effect in medio-lateral direction. Larger amplitude of body sway showed in lateral aiming condition. In conclusion, the type of precision sports and aiming posture impacted on aiming accuracy, body sway, and correlation of the target points. Specific precision training was also found benefited to aiming performance in the same standing conditions. Funding source: Ministry of Science and Technology, Taiwan.

Sample Entropy is Influenced by Practice, but not Attentional Focus in a Balancing Task

Cheng-Ju Hung, University of Florida; Hunter Alvis, Texas Woman's University; Seungho Baek, Texas Woman's University; Kevin Becker, Texas Woman's University

Recent studies have reported than an external focus can result in immediate increases in sample entropy during balancing tasks (Becker et al., 2020; Rhea et al., 2019). However, this pattern has not been replicated in a longer attentional focus training study (Diekfuss et al., 2019). The purpose of the present study is twofold. First, we aimed to characterize changes in sample entropy (SaEn) and root mean square error (RMSE) across practice when learning a balancing task with no focus cues. Second, we tested the impact of attentional focus on SaEn and RMSE following a day of practice in a balancing task. Twenty-six healthy young adults volunteered to participate in the study. On day 1, participants completed 10 practice trials balancing on a stabilometer with no focus instructions. Each trial was 20 seconds in duration and was followed by 60 seconds of rest. On day 2, participants returned to the lab and initially completed 3 baseline trials with no focus instructions. Next, they completed 3 trials each with an internal focus (keep the feet level), an external focus (keep the markers level), and a holistic focus (feeling calm and stable) in a counterbalanced order. Platform angle was captured at a frequency of 25 Hz, and SaEn and RMSE were calculated using a custom MATLAB code. Separate repeated-measures ANOVAs on practice data indicated a significant main effect of trial for both SaEn and RMSE ($ps < .001$). SaEn values increased across practice, while RMSE values decreased. Additional repeated-measures ANOVAs were conducted on SaEn and RMSE to compare values between baseline and focus conditions on Day 2. Results showed no differences due to attentional focus for either variable ($ps > .05$). These findings demonstrate that as performance of the balancing task improves, the structure of movement variability becomes less predictable. However, following an initial day of practice, attentional focus did not appear to influence the magnitude or structure of movement variability.

Attentionally-Focused Neuromuscular Training and Brain Structure-Function Coupling

Shena Hutcherson, University of North Carolina at Greensboro; Randy Schmitz, University of North Carolina at Greensboro; Kyoungyoun Park-Braswell, Indiana Wesleyan University; Louisa Raisbeck, University of North Carolina at Greensboro; Sandra Schultz, University of North Carolina at Greensboro; Derek Monroe, University of North Carolina at Greensboro

Benefits of neuromuscular training on motor performance appear to be enhanced by externally versus internally focused attention—when focus is directed to the effect of the movement in context of the surroundings rather than on the movement itself. The central mechanisms underlying this effect remain poorly understood but are plausibly due in part to altered brain network dynamics. This study examined whether attentionally-focused neuromuscular training differentially affects the spatiotemporal patterns of (de)coupling between brain functional signals and underlying white matter architecture. Healthy, young adults ($n = 29$, 17 females, ages = 21±3.2 years) were randomly assigned to external, internal, or no focus of attention (control) training groups. All participants completed 8 weeks of lower extremity strengthening and balance exercises. A single leg hop (SLH) test was conducted before and after training alongside multimodal MR imaging. A graph signal processing approach was used to derive a structural decoupling index (SDI) between brain function (standardized BOLD signal) and the underlying white matter structural connectome (number of white matter fibers between areas) in 360 cortical areas. Partial least squares correlation analysis revealed one latent variable (LV1, $p < .001$) characterized by greater coupling (lower SDI) in somatomotor and cingulo-opercular networks and a second latent variable (LV2, $p = .014$) characterized by higher SDI in visual and default mode networks. Linear mixed-effects models further revealed that individual expression of the SDI pattern ('brain score') in LV1 predicted better SLH, independent of group or time. Whereas for LV2, compared to controls, only those in the external focus group increased SLH pre- to post-training ($p = .002$) and exhibited a positive predictive relationship between brain score and SLH ($p < .001$). In conclusion, we report distinct patterns of brain organization that are associated with superior lower-limb motor performance and may represent the neuroplastic effects of externally focused training.

Examining the Benefit of tDCS at M1 for Protecting New Motor Memory From Interference

Angelina Huynh, Texas A&M University; Joshua Deeman, Texas A&M University; Hakjoo Kim, Texas A&M University; David Wright, Texas A&M University

Consolidation is recognized as a post-practice process critical for stabilizing labile motor memories. Implementation of this process relies on the learner having sufficient uninterrupted time between training and test or exposure to sleep. It has been demonstrated that consolidation of a motor skill is improved when acquisition is coupled with anodal transcranial direct current stimulation (atDCS) at primary motor cortex (M1). In contrast, administration of tDCS after practice is not sufficient to aid consolidation. Taken together, these data suggest that pairing training and exogenous stimulation is central to how supplemental stimulation fosters more stable motor memory. The present work probed this hypothesis by examining the efficacy of simultaneous training and anodal tDCS at M1 for protecting a novel motor memory from interference. Specifically, all

participants experienced 200 trials of practice of an eight-element motor sequence which was followed by a test administered six hours later. For one condition, during the initial practice phase, individuals experienced sham tDCS at right M1. A second condition that also involved sham tDCS during initial practice included an additional 200 trials of training with an alternative motor sequence immediately after practice with the target motor sequence. A third condition, experienced practice of both the target and interfering motor sequences; participants in this condition also received anodal tDCS at M1 during practice of the target task. With respect to the target motor sequence, for the sham conditions, performance stability from training to test should be impeded by the presence of interfering practice. The disruption induced by interfering practice was expected to diminish when practice of the target sequence was paired with exogenous stimulation. While interference destabilized the memory for a newly acquired motor sequence and exposure to tDCS during training reduced this disruption, these effects failed to meet conventional significance levels.

Effects of Different Criteria for Success on Motor Skill Acquisition in Children

Takehiro Iwatsuki, Pennsylvania State University, Altoona College; Seyyed Mousavi, University of Isfahan; Jalal Dehghnizade, Urmia University; Shota Yoshihara, Kitasato University

The purpose of this study was to examine the effects of different success criteria on motor learning in children. Forty-eight children threw soft-golf balls towards a circular target using their non-dominant arm. On Day 1, they performed six blocks of 12 trials from 5.5 meters. On Day 2, they performed 1 block of 12 trials on separate retention (5.5 meters) and transfer tests (6.5 meters). Participants were randomly assigned to one of four groups: Difficult Criterial for Success (DS), Relatively Easy Criteria for Success (RES), Easy Criteria for Success (ES), and Control (CON; receiving no success criteria for success) group. After the first block (pretest) of 12 trials on Day 1, the participants were provided with one of the four instructions while practicing 5 blocks of 12 trials, in 60 trials. On Day 2 (48 hours from the practice), 12 trials of retention and transfer tests were conducted. Results demonstrated that the main effect of the practice phase on performance was significant; however, the main effect of the group and interaction of the group and block were not significant. There was a significant difference between the RES and the control groups on their throwing accuracy on the retention ($p = .040$) and transfer ($p = .043$) tests. In the descriptive analysis, participants in the RES had the higher accuracy score than the other three groups. This research suggests that providing relatively easy criteria facilitate motor skill acquisition in children.

Post-Exercise Minimal Clinically Important Difference of the European Quality of Life-5 Dimensions-3 Levels in Older Adults With a History of Falls

Deborah A Jehu, Augusta University; Jennifer C Davis, University of British Columbia-Okanagan Campus; Kenneth Madden, University of British Columbia; Naaz Parmar, University of British Columbia; Teresa Liu-Ambrose, University of British Columbia

The minimal clinically important difference (MCID) is critical for understanding whether observed changes (e.g., following exercise) are meaningful. The MCID of preference-based health utility instruments is not established in older adults with a history of falls – a population with low health-related quality of life (HRQoL). Therefore, the purpose of this study was to establish the MCID of a HRQoL measure – European Quality of Life-5 Dimensions-3 Levels (EQ-5D-3L) – in older adults with a history of falls following exercise. This study is a secondary analysis of 255 complete cases who were enrolled in a 12-month randomized controlled trial (NCT01029171; NCT00323596); participants were randomized to the Otago Exercise Program (OEP; $n = 126/172$; Age: 81.2±6.2 years; 60.3% Female) or control (CON; $n = 129/172$; Age: 81.7±5.7 years; 70.5% Female). The OEP included physical therapist-prescribed strength and balance exercises for 30 minutes, 3x/week, for 12 months. Participants completed the EQ-5D-3L and Visual Analogue Scale (VAS) at baseline and 1-year (i.e., trial completion). The VAS is associated with HRQoL and was the health status anchor; a meaningful change difference on the VAS is ≥11 or ≤-11. We used three distinct approaches to estimate the MCID ranges, which included: 1) the anchor-based change differences of the EQ-5D-3L (1-year minus baseline) observed in participants receiving the OEP with meaningful changes in the VAS (≥11 or ≤-11 points) subtracted from CON; 2) anchor-based beta coefficients from ordinary least squares regressions; and 3) distribution-based standard deviation and standardized effect size of 0.5. Across the three approaches, MCID improvement for the EQ-5D-3L ranged from 0.060 to 0.122 (Change Difference Approach=0.074; Regression Approach=0.122; Distribution-Based = 0.060), and declines ranges were -0.060 to -0.076 (Change Difference = -0.076; Regression = -0.071; Distribution-Based = -0.060). Our results will assist in the interpretation of changes in HRQoL following exercise in older adults with a history of falls. Funding: CIHR, MSFHR. Funding source: This study was funded by the Canadian Institutes for Health Research (MOP-110954 and MAT-92025). Dr. Liu-Ambrose is a Canada Research Chair (Tier 2) in Physical Activity, Mobility, and Cognitive Neuroscience, at the University of British Columbia. Dr. Davis is a career scholar funded by the Michael Smith Foundation for Health Research. Dr. Jehu was a funded postdoctoral fellow through the Michael Smith Foundation for Health Research. The funders played no role in the design, conduct, or reporting of this study.

Comparison of Timing Accuracy and Coordination Stability According to the Perceptual Information and Movement Characteristics in Virtual Reality

Jaeuk Jeong, Seoul National University; Seonjin Kim, Seoul National University

According to ecological theory, it is a main concern how the perception and action are coordinated. And this perceptual-action coordination brings about differences in timing accuracy and movement stability according to the suitability between the properties of perceptual information and motion characteristics. In particular, it has been reported that auditory information is effective for timing accuracy and consistency when performing a timing task, but the studies on various sensory conditions and their combinations are insufficient. Therefore, in this study, the performance of timing tasks was compared according to the sensory modalities, tempo and the stability of motion. Participants ($N = 30$, $M_{age} = 29.4 \pm 3.4$ years) performed a timing task of bringing both hands together to a target in virtual reality according to the auditory signals of four conditions (0.5Hz, 1Hz, 2Hz, 3Hz) provided at regular intervals. The in-phase group performed the task of clapping while bending the knee, and the anti-phase group performed the same task while stretching the knee. Timing accuracy and consistency were calculated by absolute error (AE) and SD of AE, and stability of motion was analyzed using *SD* of continuous relative phase. As a result, the timing accuracy and stability of motion were higher in the in-phase group than in the anti-phase group ($p = 0.02$). In particular, as the speed increased in the auditory condition, a phase transition was found in the anti-phase group, but was not found in the visual condition. Also, under fast tempo condition, the timing accuracy was high ($p = .008$) in visual information, but under the slow tempo condition, visual & auditory information was higher than other conditions ($p = .04$). In summary, the in-phase motion is more stable and effective for timing performance than anti-phase under auditory and fast tempo. Through these results, it can be seen that the combination characteristics of perception-action should be explored more

specifically according to the stability of the movement itself, the modality of sensory information, and the tempo.

Assessing the Environmental Context of a Daily Walk for Health and Well-Being

Georgiana Juravle, Alexandru Ioan Cuza University; Ioana Andreea Campanu, Alexandru Ioan Cuza University; Cristina Condratiuc, Alexandru Ioan Cuza University; Gabriela Neagu, Alexandru Ioan Cuza University; Radu Antohe, Alexandru Ioan Cuza University; Delia-Elena Diaconasu, Alexandru Ioan Cuza University

A daily walk holds the promise of a health-boosting habit. Here, we present preliminary data from a longitudinal study designed to assess the benefits of walking and optimize walking for health. Specifically, we were interested to assess how long is one healthy walk, whether the walking environment affects health and well-being, as well as to describe which are those environmental and psychophysiological factors necessary to make walking a healthy habit. Ninety participants undertook a walking regime over six weeks, with one hour walking performed for at least 5 days/week. Physiological measurements were performed before and after the scheduled six weeks of walking. One experimental group walked in the city, another in the park, and the control group did not walk, but nevertheless took part in all physiological measurements. Health was assessed by physical activity levels (all participants were equipped with Mi band 5 sports bracelets), body anthropometric measurements, lung capacity, heart function, blood profiles (e.g., triglycerides and cholesterol), and daily ecological momentary assessments of subjective mood and well-being. Participants also completed several questionnaire batteries to assess body image and subjective well-being. To investigate any habit formation, 6 weeks after the termination of the walking part of the study participants were re-tested on all health parameters and were interviewed about their walking activities.Preliminary results highlight positive associations between activity level, environmental context, and the monitored daily mood and well-being, with the relationship moderated by the measured anthropometric indices. These data are discussed with respect to the development of technologies to improve objective and subjective well-being, within the fields of motor control and health sciences. Funding source: This work is funded by a grant from the Romanian Ministry of Education and Research, CNCS-UEFISCDI, project number PN-III-P1-1.1-TE-2019-1699.

Bimanual Force Control in Simulated Martian Gravity

Deanna M. Kennedy, Texas A&M University; Yiyu Wang, Texas A&M University; Madison Weinrich, Texas A&M University; Renee Abbott, Texas A&M University; Ana Diaz-Artiles, Texas A&M University

Recent research has indicated that bimanual force control is altered in microgravity environments (Diaz-Artiles, 2022). The next milestone in human space exploration is sending humans to Mars. Therefore, understanding human performance in Martian gravity is also of critical importance. The current experiment was designed to determine if the bimanual control of force changes with exposure to simulated Martian gravity. A tilt table was used to simulate gravity on Mars (22.3° head-up tilt (HUT)). Right limb dominant participants ($N = 10$) were required to produce a rhythmical 1:2 coordination pattern by producing a pattern of force with their left and right arms. Lissajous information was provided to guide performance. Participants performed 14, 30 s practice trials at 90° HUT (Earth). Following a 30-minute rest period participants performed 2 test trials for the Earth and Mars conditions, with no previous exposure to simulated Martian gravity. Performance during the two test trials were compared. Results indicated that participants could perform the goal pattern in both gravity conditions. However, greater temporal accuracy was observed for the Earth condition than for the Mars condition. The results also indicated differences in the control of force between Mars and Earth. More specifically, results indicated that mean force production for the left limb was significantly greater for Earth than for Mars. Results also indicated that force variability was greater for the left limb for Earth than Mars. The results suggest that bimanual control is altered in Martian gravity and further research is needed to fully understand how altered-gravity environments influences the neural control of motor actions. Funding source: NASA 80NSSC20K1499.

Functional Mobility and Postural Control in People With Parkinson's Disease: Using a Multiple Baseline Design

Adam King, Texas Christian University; Zoe Thijs, Texas Christian University; Ryan Porter, Texas Christian University; Joshua Carr, Texas Christian University; Christopher Watts, Texas Christian University

The evaluation of population-based health interventions poses several challenges (accessibility, heterogeneous characteristics, etc.) when attempting to determine efficacy and effectiveness. One approach, used in educational and clinical practice, that has the potential to offer insight into such circumstances is called a multiple-baseline design, in which multiple aspects of behavior are measured both before and after a treatment. The aim of this study was to determine the utility of a multiple baseline approach in a small sample ($N = 4$) of individuals with mild-moderate (Hoehn and Yahr scale: 1, $n = 2$; 3, $n = 2$) Parkinson's Disease (PD). Three testing sessions were used for baseline assessments and evaluated functional mobility characteristics using a Maximum Step Length (MSL) task and Multidirectional Reach Task (MDRT). Postural control was also examined with modified Romberg balance tasks (eyes open, eyes close, and eyes open on foam mat) for two repetitions of 15 second trials. Using a composite score for MSL and MDRT and traditional postural sway metrics, the reliability of the multiple baseline sessions was evaluated using intra-class correlations. Functional mobility ICCs were found to have excellent reliability (0.91 – MSL; 0.90 – MDRT); whereas, center-of-pressure area fell into a good reliability rating (0.68, 0.71, and 0.82 for eyes open, eyes close and on a foam mat, respectively). Overall, the three baseline sessions provided good to excellent reliability and appeared to be adequate for the implementation of a multi-baseline design. A secondary aim of the study is to evaluate the effectiveness of a boxing exercise intervention on these mobility characteristics and further demonstrate the application of a multiple baseline design within this population when the data becomes available.

Using fNIRS to Detect Prefrontal Cortex Changes Due to EMG Biofeedback Walking and Training in Healthy Adults

Reza Koiler, University of Delaware; Elham Bakhshipour, University of Delaware; Nancy Getchell, University of Delaware

Electromyography biofeedback (EMG-BFB) of plantar flexors is a promising gait rehabilitation technique to improve walking function and speed and induce appropriate phasic activity in calf muscles of older subjects and stroke patients. While EMG-BFB has been shown to improve gait, corresponding changes in underlying cortical neural mechanisms is not clear. These neural biomarkers will help quantify plasticity, adaptive motor learning and automaticity. In this study we investigated the neural correlates of EMG-BFB walking, and training, in prefrontal cortex (PFC), using functional near-infrared spectroscopy (fNIRS). Twenty-four participants walked on an instrumented treadmill at their preferred walking speed and a higher speed corresponding to 60 percent higher peak medial gastrocnemius activity, during the push-off phase of the gait. mTrigger, a portable EMG-BFB device, which we repurposed and validated for gait training, emitted auditory feedback at each step that subjects reached the higher EMG activation threshold. Subjects alternated between normal walking

and EMG-BFB walking for a total of six trials. Audio feedback was off, during pre and post trials, to test for training effect. Audio feedback on, during four training trials. We found that EMG-BFB walking was associated with higher oxygenation of the PFC for all participants compared to self-selected walking ($p < .001$). This indicates higher task-specific PFC demand. Additionally, we found that four, five-minute trials of training with mTrigger resulted in attenuation of change in PFC oxygenation between EMG-BFB walking and self-selected walking when comparing pre-training and post-training ($p < .05$). This indicates less expenditure of cortical resources after training and a possible PFC biomarker for greater automaticity and adaptation to EMG-BFB walking. Funding source: DE Bioscience CAT Applied Research Collaborations; American Stroke Association.

Effects of Yoga on Fractionated Reaction Time in Patients With Parkinson's Disease

Katerina Kole, Wayne State University; Qin Lai, Wayne State University

Parkinson's disease (PD) is a chronic and progressive neurodegenerative disorder, leading to the impairments of motor function, movement, and coordination among the individuals. Previous research indicated physical exercise decreased reaction time among the patients with mild to moderate PD. This pilot study further investigated the influence of an 8-week Yoga intervention on the premotor time (PMT), motor time (MT), and reaction time (RT) in PD patients. 14 patients were equally classified as two groups based on their PD Stages, where Stage 2-2.5 represents mild symptoms as Group 1 and Stage 3-4 represents mid-severe symptoms as Group 2. During the 8-week yoga intervention, all the groups participated in two 60-minute yoga sessions on a weekly basis. Every patient participated in a Pre-Test (one week before the start of Yoga intervention) and in a Post-Test (one week after the end of Yoga intervention), where they were instructed to depress a hand pedal by extending the right arm as fast as possible when a stimulus (green light) appeared on a computer screen. Each test consisted of 16-trials practice, with RT as feedback for each trial. To factionalize reaction time, the surface electromyography (sEMG) was recorded from the lateral triceps with Biopac's data acquisition system, triggered by E-Prime software. A 2 (Group) x 2 (Test) ANOVA with repeated measure on Test found group differences on RT ($p < .01$), PMT ($p < .01$), and MT ($p < .01$). Tukey's HSD Test showed that Group 1 performed faster RT and RT components compared to Group 2. More importantly, the analysis demonstrated test differences on RT [$F(1, 12) = 11.84$, $p < .01$] and PMT [$F(1, 12) = 16.88$, $p < .01$] but no difference on MT ($p > .05$). Further, Tukey's HSD Test revealed all the patients decreased their RT and PMT on Post-test relative to Pre-test. These results indicates that 8-weeks Yoga might facilitate the central process speed instead of the muscle activation among the patients from mild to mid-severe stages.

Analysis of Brain Activity During Dual-Task Walking in Individuals With Parkinson's Disease

Jongmin Lee, California State University, Northridge; Takuto Fujii, California State University, Northridge; Mayumi Wagatsuma, University of Delaware; Taeyou Jung, California State University, Northridge

Our daily activities require performing multiple tasks at once, such as walking and talking. People with neurological disorders often have difficulty in dealing with dual-task performance. Limited studies have examined brain responses to dual-task walking (DTW) in people with Parkinson's disease (PD). The purpose of this study was to investigate cortical hemodynamic responses of the prefrontal cortex (PFC) during DTW in people with PD. Changes in the PFC response were then compared to those without PD. Ten individuals with PD (aged 72.8 ± 5.53) and ten healthy controls (70.4 ± 9.66) were asked to walk in three task conditions at a comfortable pace: walking only (W), walking and talking (WT), and walking with simple math problem-solving (serial subtraction 3) (WM). All participants completed five walking trials for each condition on a 30-meter walkaway. A functional near-infrared spectroscopy system measured oxyhemoglobin (HbO2) values of the PFC during each walking trial. Repeated ANOVA showed no significant differences in HbO2 across three conditions in the PD group, whereas the control group revealed significant changes during DTW as compared to W ($p < .05$). In post-hoc analyses, the mean HbO2 of the control increased by 107.85% from W to WT and decreased by 108.38% from W to WM (all p-values $< .05$). A 2×3 mixed-model ANOVA showed no significant group x condition interaction. The PD group, however, showed greater HbO2 than the control in all walking conditions. The brain activity in the prefrontal lobe of people with PD does not appear to reflect the impact of concurrent cognitive tasks during walking. Walking itself can be an overwhelming task for people with PD, regardless of an additional cognitive task. Also, our findings support that people with PD must engage greater brain activation to walk, as well as walk with a concurrent task than those without PD. It is recommended that an appropriate level of cognitive load should be considered for dual-task motor training in people with PD.

Direction of Attentional Focus in Prosthetic Training: Current Practice and Potential for Improving Motor Learning in Individuals With Lower Limb Loss

Szu-Ping Lee, University of Nevada, Las Vegas; Alexander Bonczyk, University of Nevada, Las Vegas; Maria Katrina Dimapilis, University of Nevada, Las Vegas; Sarah Patridges, University of Nevada, Las Vegas; Samantha Ruiz, University of Nevada, Las Vegas; Lung-Chang Chien, University of Nevada, Las Vegas; Andrew Sawers, University of Illinois at Chicago

Adopting an external focus of attention has been shown to benefit motor performance and learning. However, the potential of optimizing attentional focus for improving prosthetic motor skills in lower limb prosthesis (LLP) users has not been examined. In this study, we investigated the frequency and direction of attentional focus embedded in the verbal instructions in a clinical prosthetic training setting. Twenty-one adult LLP users (8 female, 13 male; 85% at K3 level; mean age = 50.5) were recruited from prosthetic clinics in Nevada. Verbal interactions between LLP users and their prosthetists (mean experience=10 years, range = 4-21 years) during prosthetic training were recorded. Recordings were analyzed to categorize the direction of attentional focus embedded in the instructional and feedback statements as internal, external, mixed, or unfocused. We also explored whether LLP users' age, time since amputation, and perceived mobility were associated with the proportion of attentional focus statements they received. We recorded a total of 20 training sessions, yielding 904 statements of instruction from 338 minutes of training. Overall, one verbal interaction occurred every 22.1 seconds. Among the statements, 63% were internal, 9% external, 3% mixed, and 25% unfocused. Regression analysis revealed that female, older, and higher functioning LLP users were significantly more likely to receive internally-focused instructions (p=0.006, 0.035, and 0.024, respectively). Our results demonstrate that verbal instructions and feedback are frequently provided to LLP users during contemporary prosthetic clinical practice. Most verbal interactions are focused internally on the LLP users' body movements and not externally on the intended movement effects. While more research is needed to explore how motor learning principles may be applied to improve LLP user outcomes, overreliance on internally-focused instructions as observed in the current study may hinder prosthetic skill learning. Funding source: Encompass Health Corporation and National Institute of Health.

The Effects of Reactive Exercise Intervention on Stroke Patients – An Exploratory Study

Yuhua Li, The University of Memphis; Rohini Bhole, University of Virginia; Andrei Alexandrov, The University of Tennessee – Health Science Center at Memphis; Erik Furseth, The University of Memphis; Zoey Kearns, The University of Memphis

Stroke is the leading cause of long-term disability in the United States. Previous research shows that exercise helps with neurologic deficits from stroke. The purpose of the current study was to examine the effects of mixed method approach using reactive exercise and strength training on lower limb functions for stroke patients. Patients 40-80 yrs. of age were recruited. Inclusion criteria includes 1) within 10 weeks of stroke; 2) after completion of their standard inpatient or outpatient rehab; 3) modified Rankin Scale (mRS) score of < 4. Exclusion criteria were inability to perform the exercises due to musculoskeletal problems and if > 3 months from stroke. Blocked randomization technique used to balance the group assignment based on age, gender and mRS. Participants were randomly assigned into the exercise intervention (EIV: a 4-week reactive exercise program on Quick Board) and control group (CON: no intervention). A lower-limb strength test, static and dynamic balance test (NeuoCom system) and stroke assessments (NIHSS, Barthel Index, mRS) were conducted during the pre, 4-week posttest and another 4-week follow-up test for all participants. A 2 (groups) X 3 (tests) ANOVA with repeated measures on the second factor was used to examine the effects of exercise intervention on lower limb function recovery. Ten patients were enrolled (mean age = 62.9 yrs). The results revealed no significant effect for both static and dynamic balance tests. However, the EIV group showed 11.8% improvement on MXE score of dynamic balance test in the posttest, compared with 6.7% for the CON group. Moreover, a significant interaction between Group and Test ($p < .01$) on mRS was found. Further analysis indicated that EIV group had a significant improvement on stroke assessment scores in the posttest, but not in the CON group. Overall, there was a trend towards improvement with reactive exercise intervention, and the reactive exercise intervention program was well received by patients. Further testing with large scale studies is needed for conclusive data.

Changes in Attentional Focus Failed to Mediate Shooting Performance in Experienced Performers

Pin-Chen Lin, New Mexico State University; Sean Cochran, New Mexico State University; Christopher Aiken, New Mexico State University

Previous research examining the accuracy of firearm shooting has shown a benefit for adopting an external focus of attention (Raisbeck et al., 2017). Recent research has also demonstrated that adopting a holistic focus of attention (e.g., focus on the general feeling of the movement) has similar performance benefits as observed with an external focus (Becker et al., 2019). Little is understood about the effects of a holistic focus within more experienced performers. The purpose of this study is to investigate the effects of various attentional focus strategies on performance with experienced shooters. Thirteen experienced shooters (self-reported and able to complete pre-testing) performed 30 trials of a shooting task. Participants used a Berretta model-92 handgun fitted with a dry fire SCATT shooting system (Moscow, Russia) to fire at a 17 x 17cm target from a distance of 5.5m. Each participant completed a baseline test of five trials followed by the completion of six blocks of five trials in which a holistic, external, or internal focus was assigned in a counterbalanced order. Following data collection participants indicated how well they focused on the instructed cue by using a visual analog scale to indicate the percent of the time focused on the prescribed attentional focus. A repeated-measures ANOVA failed to find a significant difference between the attentional focus conditions ($p > .05$) and baseline performance ($p > .05$). There was also no significant difference observed between adherence for the various attentional focus conditions ($p > .05$). Our results are at odds with previous research showing a benefit to an external focus with firearm shooting accuracy in novice performers. It is possible that the participants of the study were performing at their maximum level and the subtle change in attentional focus was not enough to alter performance levels. Research should continue to investigate how skilled performers use attentional focus within their skill domain.

A Systematic Review of Smartphone Apps Designed to Measure Gait and Posture

Robert C. Lockhart, University of North Carolina at Greensboro; Christopher K. Rhea, University of North Carolina at Greensboro

As smartphone integration into daily life continues to increase in congruence with the amount and type of technology contained within smartphones, it stands to reason that the uses and capabilities of this technology will continue to increase, and with that, the types of data collected and effectively utilized. One aspect that continues to show itself useful is the ability to monitor gait and posture parameters with increasing accuracy and precision; and has come to show growing potential in many areas including disease monitoring and management, behavioral intervention, and more. This review explores the scope of smartphone technology utilization regarding gait and posture monitoring. Keyword searches were conducted in March 2021 using PubMed, psychINFO, EBSCO, SPORTDiscus, and Google Scholar, returning 443 unique results. Articles between the years of 2013-2021 were included if the focus employed mHealth or smartphone app technology for gait or posture measurements or monitoring without the need of outboard sensors, which yielded 33 results. This review focused on the population studied, data input modality, and outcome variables. Of the populations studied, 9 observed only clinical populations, 14 observed only healthy populations, and 10 observed both. Clinical populations that were included were Parkinson's disease ($n = 10$), tremor ($n = 9$), stroke ($n = 4$), increased fall-risk ($n = 3$), multiple sclerosis ($n = 2$), hypertension ($n = 1$), and post-structural surgery ($n = 1$). Four studies utilized smartphones for static postural measurements only, 10 for dynamic postural measurements only, and 13 measured both; the remaining studies used the smartphone app as a pedometer and/or activity monitor. Thirteen studies included gait analysis after recorded data were transmitted to a cloud server or downloaded from phone memory; no studies were found to utilize smartphone internal processing for gait analysis. This review shows that smartphone apps have been shown to have a variety of utility in gait and posture research.

The Effects of Virtual Reality Practice on Motivation and Performance

Logan Markwell, University of Tennessee Knoxville; Andrew Strick, University of Tennessee Knoxville; Joei Velten, University of Tennessee Knoxville; Andy Shaw, University of Tennessee Knoxville; Olivia Garrett, University of Tennessee Knoxville; Julie Partridge, Southern Illinois University Carbondale; Jared Porter, University of Tennessee Knoxville

Studies have demonstrated improvements in real-world motor performance following practice within an immersive virtual reality (VR) environment. One possible advantage is the level of motivation that VR might provide when compared to a real environment. Given that research has suggested the potential learning benefits from increased intrinsic motivation, it would be valuable to understand how VR impacts motivation. Therefore, the purpose of this study was to compare the differences in intrinsic motivation and performance between VR practice and physical practice of the same motor skill. We hypothesized that measures of intrinsic motivation would be greater when practicing a task in VR

compared to physical practice. Participants ($N = 33$) were randomly assigned to a VR practice group ($n = 18$) and a physical practice group ($n = 15$) in which they performed a miniature golf putting task. On day 1, participants completed an intrinsic motivation inventory (IMI), performed a 10-trial pre-test, a 50-putt acquisition phase, and completed a second IMI following the acquisition phase. Participants returned on day 2 to perform a 10-trial post-test. Following a 2 (condition) x 4 (test phase) repeated measures ANOVA, the results revealed a significant change in intrinsic motivation scores ($p = .003$). Post-hoc analysis showed that VR practice led to a significant increase in the average IMI score while physical practice did not change. Analyses for performance showed that there was a statistically significant ($p = .021$) improvement in accuracy (i.e., radial error), but the two groups did not differ from one another. An additional analysis for performance showed that there were no significant changes in precision (i.e., bivariate variable error). Overall, these results support our hypothesis and suggest that motor skill practice in VR led to a significantly greater increase in motivation compared to physical practice of the same motor skill. These results also suggest that practice in VR was equally effective at facilitating motor learning compared to physical practice.

Investigating the Biomechanical Fidelity of Immersive Virtual Reality in Dart Throwing: A Pilot Study on Upper Body EMG

Logan Markwell, University of Tennessee Knoxville; Andrew Strick, University of Tennessee Knoxville; Kaileigh Estler, University of Tennessee Knoxville; Jared Porter, University of Tennessee Knoxville

Transfer of learning can occur from practice within immersive virtual reality (VR) to a real-world (RW) context. However, recent reports have questioned the extent to which the VR practice can differ while still eliciting RW performance improvements. No published reports have investigated differences in electromyography (EMG) during immersive VR and RW dart throwing tasks. Therefore, the aim of this pilot study was to determine differences in upper limb muscle EMG during VR and physical motor skill practice. Single upper limb EMG analysis included the biceps brachii (BB), triceps brachii (TB), deltoid anterior (DA), and pectoralis major (PM). Maximum voluntary isometric contraction (MVIC) value were obtained for normalization. The participant then performed a total of 130 dart throws in a single practice session within 5 conditions: pre-test, RW practice, mid-test, VR practice, and post-test. The pre-test, mid-test, and post-test consisted of 10 dart throws, each. Fifty dart throws were performed during each practice condition, the first 9 of which were recorded in all 5 conditions. The EMG data were analyzed using Root Mean Square (RMS), followed by four one-way ANOVAs with post-hoc least significant difference (LSD) tests to examine the differences between groups. The analysis revealed statistical significant differences in peak EMG activation for the BB and PM with near significance of the TB ($p = .06$). Post-hoc LSD tests further revealed significant differences in BB peak EMG activation for the VR practice condition compared to RW practice, mid-test, and post-test. Additional analyses found differences in TB peak EMG activation in VR compared to pre-test, RW practice, and post-test. Lastly, differences in PM peak EMG activation were found in VR compared to the post-test. While immersive VR environments may replicate similar visual environmental characteristics of the RW, these results indicate some differences in movement production (i.e., muscle activation). These findings could have implications on transfer of learning from VR to RW contexts.

Topics in Motor Behavior and Sport and Exercise Psychology: A Hub for Undergraduate Integrative Research Capstone Courses

Anthony Mayo, San Francisco State University; Nicole Bolter, San Francisco State University; David Anderson, San Francisco State University

Many kinesiology departments desire their undergraduates to have an understanding, appreciation, and respect for the multidisciplinary nature of kinesiology upon graduation. However, while departments offer classes in the various subdisciplines, few offer a class that enables students to appreciate how these subdisciplines are integrated into a coherent whole. One way to accomplish this objective is through a capstone undergraduate research experience course, where students have the opportunity to investigate research questions based upon an over-arching theme related to physical activity. For over 25 years, the Kinesiology Department at San Francisco State University has offered an integrative research class where students design, develop, and conduct research that crosses the kinesiology subdisciplines. We assert that topics in motor behavior and sport and exercise psychology can be the focal point for a kinesiology integrative research capstone class. Many of the questions at the forefront of current research in motor behavior and sport and exercise psychology are inherently transdisciplinary in nature and can only be addressed adequately by diverse teams of researchers. Prior to the Covid-19 pandemic, students conducted research that addressed themes such as attentional focus, music and performance, and instruction and performance. During the pandemic, students have conducted research to address the theme Covid-19 and physical activity. In this presentation, we will describe the most recent pre-pandemic research projects based on the theme instruction and performance, as well as a current project based on the theme Covid-19 and physical activity. We will show how student research projects address the overarching theme and how the projects cross the subdisciplines of kinesiology. In addition, we will discuss the centrality of motor behavior and sport and exercise psychology to kinesiology and the challenges and benefits of an integrative research course.

The Benefits of an External Focus of Attention are Negligible After Correcting for Publication Bias: A Re-Analysis and Extension of Chua et al. (2021)

Brad McKay, McMaster University; Abbey E. Corson, University of Ottawa; Jeswende Seedu, McMaster University; Celeste S. De Faveri, McGill University; Hibaa Hasan, McMaster University; Kristen Arnold, McMaster University; Faith C. Adams, McMaster University; Michael J. Carter, McMaster University

Evidence has ostensibly been accumulating over the past two decades indicating that an external focus of attention is superior to an internal focus for the learning and performance of motor skills. Recently, Chua and colleagues (2021) conducted five meta-analyses and concluded that an external focus of attention is superior for (1) retention, (2) transfer, and (3) performance of motor skills; results in (4) reduced electromyographic (EMG) activity during performance, and further, that (5) more distal external foci are superior to proximal external foci for performance. The authors claimed that "no amount of publication bias could attenuate the observed overall [effect size] to the null value" for each analysis; however, only one limited form of publication bias was evaluated. Here, we re-analyzed the data reported by Chua and colleagues using robust Bayesian meta-analysis methods that included several plausible models of publication bias. We found moderate to strong evidence of publication bias for all five meta-analyses. After correcting for publication bias, estimated mean effects were negligible: $g = .01$ (performance), $g = .15$ (retention), $g = .09$ (transfer), $g = .06$ (EMG), and $g = -.01$ (distance effect). Bayes factors indicated data favored the null for each analysis, ranging from $BF_{01} = 1.3$ (retention) to 5.74 (performance). To evaluate whether the selection bias identified in our models was due to idiosyncratic data extraction methods in the original meta-analyses or due to selective publication of results, we re-extracted up to three outcome measures for each included retention effect. Multilevel models were fit to the data that included selection for the original meta-analysis as a moderator variable. Overall, our results

indicated that the effect of an external focus is likely small for learning, performance, and movement efficiency—if a reliable effect exists at all. To avoid the pernicious, obfuscating impact of publication bias, progress in this area requires adoption of large-scale registered reports. Funding source: NSERC; McMaster University.

Publication Bias and Underpowered Study Designs in Enhanced Expectancies and Self-Controlled Learning Research: A Meta-Analysis

Brad McKay, McMaster University; Mariane FB Bacelar, Auburn University; Juliana O Parma, Auburn University; Matthew W Miller, Auburn University; Michael J Carter, McMaster University

Within OPTIMAL theory (Wulf & Lewthwaite 2016), autonomy-support and enhanced expectancies form the motivational pillar, and their influence on motor learning was recently evaluated in two separate meta-analyses. McKay et al. (in press) synthesized the self-controlled learning literature, which tests the effect of autonomy by providing learners with control over practice conditions or with incidental choices. Although the meta-analysis revealed that the published literature showed a moderate and significant benefit on motor learning, further analyses revealed that putative self-controlled learning benefits are due to publication bias rather than a real effect. Bacelar et al. (2021) meta-analyzed the literature examining enhanced expectancies and motor learning and found that the published literature suggested a moderate and significant motor learning benefit. The authors found evidence of publication bias but did not fit models to correct the estimated effects. Here, we reanalyzed the data from Bacelar et al. using robust Bayesian meta-analysis methods to correct for the influence of publication bias on motor learning estimates. As publication bias can have a more severe impact on meta estimates when the underlying literature is low in statistical power, the meta-data from both meta-analyses were combined and a z-curve model was fit to estimate the average power of experiments testing the motivational pillar in OPTIMAL theory. The results suggest that publication bias substantially exaggerated the benefits of enhanced expectancies in the original meta-analysis, and the true effect is instead small, uncertain, and potentially null. The estimated average statistical power among all studies from the original meta-analyses was 6%, 95%CI [5%, 13%]. Our results strongly suggest that the available literature is insufficient to support key predictions within the OPTIMAL theory. More broadly, these results highlight the need for adequately powered experimental designs if motor learning scientists want to make evidence-based recommendations. Funding source: NSERC, McMaster University.

Persistence of Gait Asymmetries After Trip Training: A Secondary Analysis

Krista G. Meder, University of North Carolina at Greensboro; Brian L. Cone, Virginia Commonwealth University; Christopher K. Rhea, University of North Carolina at Greensboro

Studies involving older adults and clinical populations have shown trip training can increase reactive responses to trips and reduce fall risk in controlled environments. However, our previous work showed that trip training can induce gait asymmetries (e.g., step length asymmetries) in the post-training period, which could increase metabolic cost and fall risk. The extent to which gait asymmetries persist after trip training has not been explored. To address this question, older adults with no neurological or musculoskeletal injuries ($N = 30$, 74.7±4.1 years) participated in a trip training study. Participants were further divided into faller ($n = 6$) and non-faller (n=26) groups based on if they had fallen in the past year. All participants walked on an ActiveStep Treadmill in three conditions, with 5-minutes of rest between each condition: (1) 15-minutes unperturbed walking, (2) 10-minutes trip training (8 unexpected trips at random time intervals), and (3) 15-minutes unperturbed walking. The symmetry index (SI) of step length was used to calculate gait asymmetries in the post-trip condition. Further, the step length time series was truncated to 1100 steps and then portioned into windows of non-overlapping 100 step windows. The SI analysis was then run independently on each window to examine persistence of SI throughout the post-trip condition. A main effect of step window for step length SI was observed, $F(1, 20) = 118.93$, $p < .001$. Post hoc tests revealed step length SI was smaller (i.e., more symmetric gait) in the first 100 steps relative to the last three 100 step windows. These findings show that gait asymmetries were initially smaller immediately post-training, but then elevated at the end of the post-training period. The extent to which this observation was intervention and/or fatigue related remains an empirical question.

A Re-Examination of m-CTSIB Normative Data for Collegiate Athletes

Ben Meyer, Shippensburg University

The purpose of this project was to examine normative data for collegiate athletes in the modified clinical test of sensory integration in balance (m-CTSIB). Previous work (Moran et al., 2019) has assessed the differences between male and female athletes on their performance on the m-CTSIB. Results indicated that females performed slightly better than males; the present study aims to scrutinize and extend past research. Forty-seven males and thirty-six females (78 +/- 17 kg, 1.74 +/- 0.10 m, 21 +/- 3 years) performed the m-CTSIB. The test required participants to stand in several configurations: eyes open firm, eyes open foam, eyes closed firm, and eyes closed foam for 30 seconds while maintaining upright balance on a static platform. The test order was randomized for all participants. A Biodex Balance System SD (Biodex Medical Systems, Shirley, NY) was used to measure the overall sway index (SI) for each test. A composite value (the average of all tested configurations) was also computed for each participant.The sway index values were not significantly different ($p > .05$) between males and females in the eyes open firm surface test (1.02 vs 1.08) but were in the eyes open foam surface test (1.39 vs 1.62). In the eyes closed firm surface test, no significant differences were found (1.79 vs 1.99) but in the eyes closed foam surface test, the differences between genders were significant (3.66 vs 4.09). The composite value for males (1.97) was significantly different than the value for females (2.20).The results of this study add to the existing literature on balance performance in athletic populations. Males had smaller sway index values than females in all tested conditions, in contrast to previous literature. The composite sway index values from the present study (~2.0) are larger than those found by Moran et al. (2019) in their college athlete population (~1.0). Future research should utilize athletes from a wider variety of sport squads in order to provide a more complete representation of the balance capabilities of athletes.

Fatigue or Facilitation Following an Extended Fitts' Task?

Salim Mouloua, George Mason University; Daniel McConnell, University of Central Florida; Peter Hancock, University of Central Florida

Extended task performance may be either facilitating or fatiguing, but the physical and cognitive components of these effects have rarely been studied concurrently. The current study explored performance on a cognitive task of working memory span (3-back test) before and after performing a 45-minute task that varied in terms of visuomotor integration, and in terms of whether the task was physically or cognitively demanding. A discrete Fitts' pointing task was used as a task that entailed visuomotor constraints, including a physically demanding condition in which task difficulty was manipulated in

physical/effector terms, via manipulation of movement distance with target size held constant. A cognitively demanding version employed a manipulation of target size with movement distance held constant. Tasks low in visuomotor integration included a physical task involving isometric bicep contractions and a cognitively demanding vigilance task. Separate 2×2 (low vs. high visuomotor integration × physical vs. cognitive demand) ANOVAs were conducted on pre- to post-test change scores in 3-back target accuracy, non-target accuracy, target RT, and non-target RT. Overall 3-back performance improved from pre- to post-test, suggesting that all four of the extended tasks were facilitating. Tasks low in visuomotor integration resulted in larger increases in target accuracy compared to those high in visuomotor integration. Degree of visuomotor integration was not associated with any other facilitating effects. There were no effects of fatigue type nor any significant interactions between fatigue type and visuomotor integration. Facilitation was more pronounced when tasks were either purely physical (e.g., isometric contractions) or purely cognitive (e.g., vigilance), but not both, as in the case of the pointing task. Results are discussed in terms of energetics and resource dynamics.

Social Relationships Affect Interpersonal Body Synchrony

Kae Mukai, Waseda University; Tomoko Isomura, Nagoya University; Katsumi Watanabe, Waseda University

We unintentionally synchronize body with others when we act in a social environment. It has been reported that a distance between two persons affects interpersonal body synchrony. For instance, the interpersonal body synchrony is higher when the interpersonal distance is shorter. In the fields of social psychology and cognitive psychology, it has been shown that interpersonal distance varies depending on social relationships; two persons who are in a more intimate relationship tend to be physically closer. We examined whether interpersonal body synchrony would be influenced by the degree of intimacy even controlling the interpersonal distance. Twenty-three pairs of friends and loving couples participated in the study. They stood upright face-to-face or back-to-back for 50 seconds. There were 5 interpersonal distances (20, 40, 60, 80, 100 cm) in the face-to-face condition while it was 20 cm in the back-to-back condition. The center of pressure (COP) in the anterior-posterior direction was collected as an index of body sway. A cross-correlation analysis was then conducted on the time-series data of COP. The results showed that the participants generally tended to sway together more (i.e., showing higher interpersonal body synchrony) in the face-to-face condition than in the back-to-back condition. The interpersonal motor synchrony became higher as the interpersonal distance was shorter. Furthermore, the interpersonal synchrony in the face-to-face condition was higher in the pairs of loving couples than in the pairs of friends. There was no significant interaction between interpersonal distance and social relationships. Our findings suggest that social relationships affect interpersonal body synchrony independent of interpersonal distance. Funding source: KAKENHI (JSPS)21J01257; Moonshot Research and Development (JST) JPMJMS2012; Mirai Program (JST) JPMJMI20D8; KAKENHI (JSPS)17H06344.

Gaze Control and Tactical Decision Making Under Stress: Use of Force Response in Active-Duty Police Officers

Nicholas Murray, East Carolina University; Gustavo Sandri Heidner, East Carolina University; William Lewinski, Force Science Institute; Joshua Lawton, East Carolina University; Craig Allen, Force Science Institute; Robert Horn, Montclair State University

Police officers during dynamic and stressful encounters are required to make rapid decisions that rely on effective decision-making, experience, and intuition. These encounters are potentially uncontrollable, novel, and often involve time pressure that can lead to dire consequences, including injury or death. Tactical decision-making is influenced by the officer's capability to recognize critical visual information and estimation of threat. The purpose of the current study is to investigate how years of experience influence visual scan patterns in active-duty police officers ($N = 27$; $M_{age} = 32.86 \pm 7.2$ years; $M_{experience} = 7.05 \pm 6.16$ years) during a high stress, high threat, realistic use of force scenario. A secondary purpose was to examine the relationships between visual search patterns and physiological response to a threat of assault. Time to final fixation location, fixation duration, scan sequence, and heart rate were dependent measures. Overall, results demonstrated differences ($p < .05$) in time to final fixation location, scan sequence, and fixation duration by years of experience, as well as a relationship between stress response (HR) and search rate ($p < .05$). The results are discussed in light of how officers make use-of-force decisions in the field.

Balance Control in Midlife Adults With and Without ADHD

Kristina Neely, Auburn University; Zhaotong Zhang, Auburn University; Robert Blanton, Auburn University; Morgan Gladson, Auburn University; Daphne Schmid, University of Georgia; Hannah Heavlin, Auburn University; Sydni Brown, Auburn University; Savannah Brown, Auburn University; Melissa Pangelinan, Auburn University; William Murrah, Auburn University

Difficulties with balance are consistently reported in children with attention-deficit/hyperactivity disorder (ADHD); however, less is known about balance control in adults with ADHD. Since adults with ADHD experience more accidents and injuries compared to adults without ADHD, we anticipated balance would be impaired in a standing balance task. Twenty-one participants (15 women, ages 31-55) completed the Conners' Adult ADHD Rating Scale (CAARS) and the Biodex Balance SD Limits of Stability (LOS) task. Eight adults (5 women) were categorized as symptomatic based on the CAARS. In the LOS task, participants shift their weight to move a cursor from a center target to a blinking target in the periphery as quickly and accurately as possible, while maintaining contact with both feet on a firm (static) surface. Output variables were task duration and root mean square error (RMS) across all target locations, across four trials. An independent samples t-test for group (symptomatic, non-symptomatic) did not reveal differences for task duration or RMS ($ps > .05$). Next, we evaluated correlations between total time, RMS, and ADHD-symptom ratings (CAARS t-scores for Inattention/Memory Problems, Hyperactivity/Restlessness, and ADHD Index). All three symptom-rating subscales were negatively correlated with task duration and RMS, such that more severe symptoms were associated with longer task duration and greater RMS. Although none of the correlations reached traditional levels of significance ($ps > .05$), they were in the expected direction. These preliminary results have three implications. First, a larger sample size may be necessary to elucidate the nature of any differences for adults with and without ADHD. Second, the task may not be challenging enough for this population and/or may not be similar enough to real-life conditions when trips and falls happen. Last, the relationship between task performance and self-reported ADHD symptoms suggests that more work needs to be done to understand the extent to which movement control is represented in such clinical scales.

Effect of COVID-19 on Maintaining Balance in Skilled Athletes

Tomasz Niźnikowski, Józef Piłsudski University of Physical Education; Jerzy Sadowski, Józef Piłsudski University of Physical Education; Andrzej Mastalerz, Józef Piłsudski University of Physical Education; Jared Porter, University of Tennessee; Michał Biegajło, Józef Piłsudski University of Physical Education; Ewelina Niźnikowska, Pope John Paul II State School of Higher Education in Biała Podlaska; Marta Nogal, Józef Piłsudski

University of Physical Education; Logan Markwell, University of Tennessee; Oscar Romero-Ramos, University of Malaga

Preliminary studies have reported that motor control is negatively impacted following an infection of COVID-19. The purpose of this study was to evaluate the effect of COVID-19 on maintaining balance in in highly skilled athletes. As part of a larger investigation which was initiated in 2019, twelve professional handball players were recruited to participate in in a study which was designed to measure static balance performance. Following the initial pre-test, six participants (body height 184.8±4.7 cm; body weight 85.5±3.3 kg; age 21.3±1.2 years) were infected with COVID-19. The remaining six participants (body height 188.7±2.6 cm; body weight 92.3 ±3.7 kg; age 26.3±3.3 years) never tested positive for COVID-19 and were presumable not infected with the virus. The experimental design required all participants to complete an initial balance assessment (pre-test) and a later balance assessment (post-test). To fully analyze our data, we conducted a 2 (condition: COVID, no-COVID) X 2 (test: pre-test, post-test) ANOVA with repeated measures on the second factor. Our analysis revealed that the skilled athletes which contracted COVID-19 had a significant decrease in balance performance from the pre-test which occurred prior to being infected with COVID-19 relative to the post-test which occurred following the COVID-19 infection. Additionally, the skilled athletes which were not infected with COVID-19 did not demonstrate the same deterioration in balance performance in the same period of time. This study highlights the impact COVID-19 has on static balance performance in a group of highly skilled handball plyers. Longitudinal studies are needed to fully understand the lasting impacts COVID-19 has on motor behavior.

The Effects of Attentional Focus in Fine Motor Skill Learning Without Vision

Georgina Orozco, California State University, Stanislaus; Arya Alami, California State University, Stanislaus

The goal of attentional focus studies is to identify whether an internal or an external focus is more effective in improving motor learning or performance on tasks. External focus relies on focusing on the effect of the movement whereas, internal focus relies on focusing on the body movements directly (McNamara et al., 2017). The overwhelming majority of attentional focus studies conclude that better learning and performance is achieved with an external focus of attention (Wulf, 2013). The goal of this study is to investigate whether external or internal focus of attention provides a more beneficial outcome when performing a fine motor skill task without vision. Sixteen right-handed participants conducted a finger movement task without vision in control, external focus (EFA), and internal focus (IFA) conditions. Movement errors, such as omitted keys, incorrect key sequence, and repeated keys were recorded during practice trials, as was participant preferred focus strategy. While performing in the EFA condition, participants generated less movement error ($p < .05$) compared to the IFA condition. In the control condition, 56.25% of participants preferred an external focus and 43.75% preferred an internal focus. A t-test was run to determine whether there was a significant decrease in movement errors between the control condition and the last trial in both EFA and IFA conditions ($p < .05$). The t-test suggests that motor learning did occur. This is impactful because there are minimal attentional focus studies that highlight learning and performance on fine motor tasks without vision. The use of attentional focus during the instruction of exercise should be further explored. Funding source: The McNair Scholars Program.

Effects of Habituation on Spatiotemporal Gait Measures in Younger Adults

Alejandra Padilla, University of Wisconsin-Madison; Alex Peer, University of Wisconsin-Madison; Kristen Pickett, University of Wisconsin-Madison; Kevin Ponto, University of Wisconsin-Madison; Andrea Mason, University of Wisconsin-Madison

Falls are the leading cause of injury and death by injury among adults age 65 and older. Tools to accurately predict those at risk of a fall using quantitative measures are required. A promising approach involves the implementation of a Virtual Reality (VR) system as an instrument to detect fall risk. However, before we can use VR as a tool to assess fall risk, we must first understand how gait behavior in VR is affected by the altered sensory conditions in these environments. The primary aim of this study was to determine whether overground walking in VR resembles walking in natural environments and if not, whether habituation within VR can occur with practice. Nineteen young adults (ages 18-35) participated in this study. Participants were asked to walk over a GaitRite gait mat in two different conditions: (i) in a natural hallway environment for one 5-minute block (ii) in a virtual environment modeled after the natural environment for three 10-minute blocks. The virtual environment was created using an HTC Vive Pro head mounted display (HMD) system. A one-way repeated-measures (ANOVA) followed by a pairwise comparison post-hoc analysis with Bonferroni's correction was performed to compare normalized stride length, normalized stride velocity, normalized stride width and percent time in double support between the headset off condition and headset on condition. Results indicated that all spatiotemporal measures were significantly different between the headset off condition and the first five minutes of immersion ($p < .05$). However, group averages also demonstrated that after 10-15 minutes of being immersed in the virtual environment there was no statistical difference between the headset off condition and the headset on condition across any of the gait measures ($p > .05$). These findings have important implications for understanding how gait behavior is affected in VR and for the development of fall assessment tools. Future studies will examine more complex walking behaviors such as dual-task walking and obstacle clearance. Funding source: NSF.

Gaps in Brain-Machine Interface Practices Related to Neural Efficiency

Andrew Paek, Washington State University; Shikha Prashad, Washington State University

Brain-machine interfaces (BMIs) are systems that allow users to control robotic devices through their thoughts. When BMIs are used with assistive devices, such as robotic arms or exoskeletons, they can be used to help restore motor function to individuals with paralysis. These systems typically have neuroimaging hardware to scan a user's brain waves, which are used with predictive models to detect how the user wants to move their robotic device. While current BMI prototypes demonstrate that there is predictive information in neural signals, predicting motor intent with high accuracy remains a challenge. We argue that the conventional strategies used with predictive models can harm BMI performance due to induced neural efficiency. This phenomenon has been observed in motor learning studies, where motor-related neural signals are attenuated when participants perform well-practiced limb movements. This could influence a BMI's performance in predicting motor intent, which is sensitive to changes in the strength of motor-related neural signals. In this review, we highlight some problematic practices in BMIs related to neural efficiency: 1) generating training data that requires participants to perform a single motor task with a high number of trials, 2) utilizing longitudinal schedules where participants use a BMI over multiple days to attain practice, and 3) implementing adaptive algorithms that update the predictive model as participants use the BMI. These strategies are based on the assumption that the motor-related neural signals become stronger with additional practice as the user becomes habituated with the BMI. However, we speculate that these strategies are likely to induce neural efficiency,

which would weaken the neural signals of interest, and potentially hinder the performance of the BMI. Future work will explore if neural efficiency can be mitigated by varying the motor task and the task difficulty and observing if these augmented strategies can enhance a BMI's predictive power. Funding source: This work is supported by the eFellows Engineering Postdoctoral Research Fellowship from the American Society for Engineering Education (ASEE) and the National Science Foundation (NSF).

Review of Literature Utilizing Soccer Heading as a Repetitive Subconcussive Impact (RSCI) Model

John Palazzolo, University of North Carolina at Greensboro; Christopher, K. Rhea, University of North Carolina at Greensboro

Repetitive subconcussive impacts (RSCI) have become a growing area of research and concern. It has been shown that soccer heading may be a form of RSCI, with decreased balance performance acutely following bouts of soccer heading. Yet past research has lacked standardization of heading protocols and assessments, which may lead to an equivocal interpretation of the effects of RSCI-exposure. The purpose of this review was to describe previous literature which has examined the postural control effects of soccer heading. Three online databases were used to find relevant research; CINAHL Complete, PubMed, and Google Scholar were searched using a key word method including "soccer heading" and "postural control". Seven studies were found that assessed postural control pre- and post-RSCI exposure from a soccer heading task. Two of these studies used force plates to examine balance changes for up to 24 hours after RSCI exposure, while a third observed changes to the subjective BESS test in athletes with a history of 1 to 2 concussions within the previous 2 months. Contrary to these findings, three studies found no difference in balance following RSCI exposure. However, while no balance control changes were observed, significant increases in corticomotor inhibition and cognitive function were seen for up to 24 hours post-exposure in one study. A limitation in this research is the postural control measures employed have detected postural deficits following a concussion and may not always be well suited to detect balance changes after RSCI exposure. Moreover, dynamic balance assessments of neuromotor performance may be more useful in the detection of RSCI effects. Lastly, inconsistent results may further be explained by the lack of shared methodology between the studies regarding the number of impacts, velocity of the soccer ball, and type of balance assessment. Study of this problem is crucially needed, and standardization of heading protocols and balance assessments is key.

Evidence Against Target Zone Benefits for Enhancing Motor Learning: A High Powered Study Comparing Large and Small Targeted Aiming

Juliana O. Parma, Auburn University; Mariane F. B. Bacelar, Auburn University; Daniel A. R. Cabral, Auburn University; Arianna E. Fernandez, Auburn University; Josh Gann, Auburn University; Kaila Green, Auburn University; Will Homes, Auburn University; Kate Messikomer, Auburn University; Daniel Morris, Auburn University; Keith R. Lohse, Washington University School of Medicine in St. Louis; Nicola J. Hodges, The University of British Columbia; Matthew W. Miller, Auburn University

According to the OPTIMAL theory of motor learning, practice conditions that enhance learners' expectations for success are expected to improve learning. Expectations have been manipulated by easing learners' criterion for success, which can be done by instructing learners that practice trials landing within a large area surrounding a target are considered good. Several studies have tested the prediction that practicing with a larger zone of success enhances motor learning, but a learning benefit has been found primarily in those studies where the group with the large success zone was compared to a group with a small zone that yielded minimal instances of success. This pattern of results suggests that the zone-size effect may be due to the small-zone group failing to achieve a sufficient number of successful outcomes to associate with the correct action, rather than to the enhanced expectancies of the large-zone group. To explore this possibility, we had 80 participants perform a pretest of a shuffleboard task and then assigned them to practice 50 or 100 trials of the task with a large or small zone of success, so that half the participants practicing with the small zone would achieve few successful outcomes and the others would achieve more successes. The next day, participants performed retention and transfer tests. Participants significantly improved their accuracy from pretest to retention test ($p < .001$), but no interactions or main effects involving zone size and number of trials ($ps \geq .413$) were found. This study counts with the larger sample size on the topic to date, and its results question the benefit of practicing with an easy criterion of success and fail to shed light on the reason for the mixed evidence in past studies. We recommend more high-powered research on the topic that considers potential moderating variables such as motivational mindset.

"One Hand Does Not Know What the Other is Doing": No Interlimb Interference From a Secondary Adaptation When it is Learned Implicitly

Aarohi Pathak, University of Toronto; Adarsh Kumar, Indian Institute of Technology Gandhinagar; Timothy N. Welsh, University of Toronto; Pratik Mutha, Indian Institute of Technology Gandhinagar

Skilled motor behaviour is dependent on the ability to adapt movement patterns to new environmental or task conditions. Motor adaptation has been extensively studied using targeted reaching tasks in which the visual outcome of an action (cursor motion) is presented in a manner that is inconsistent with (rotated away from) the actual motion of the effector (hand motion). This rotation requires actors to adapt their actual movement direction to land the cursor on the target. Many studies have revealed that the memory acquired via motor adaptation is susceptible to interference from competing sensorimotor memories developed via adaptation to different mappings. That is, when a learner adapts to a rotation A and then adapts to an opposite rotation B in close succession, the performance and re-learning of A after 24 hours tends to be as errorful as when A is performed for the first time. Such interference is observed even when two separate effectors learn A and B (an "interlimb" interference). The present study investigated whether this kind of interlimb interference is driven by implicit processes. All groups adapted to a rotation A (abrupt rotation of 30° in the clockwise direction) with one hand and then rotation B with the other hand. When learning B, Group 1 ($n = 30$) achieved a 30° counter-clockwise rotation in a gradual manner (0.15° per trial) while Group 2 ($n = 30$) adapted in a "clamped" condition with the cursor moving 30° counter-clockwise from the target direction on every trial regardless of the actual hand movement. Both methods are believed to tap primarily into implicit learning processes that drive motor adaptation. Results revealed no interference between the two memories – both Groups showed clear retention of A when tested 24-hours later. These data suggest that multiple motor memories can be learned and retained using different effectors if they are implicitly acquired. These findings have important implications for sports training and rehabilitation paradigms involving both effectors. Funding source: Natural Sciences and Engineering Research Council of Canada Discovery Grant and Mitacs Globallink Award.

A Scoping Review on the Developmental Activities of Girls' and Women's Sports

Carrie M. Peters, University of British Columbia; David T. Hendry, Northumbria University; Nicola J. Hodges, University of British Columbia

We present a scoping review of the research on the developmental pathways to expertise in girls' and women's sports. Data pertaining to these pathways are contextualized within deliberate practice theory and associated models, such as the Developmental Model of Sport Participation. Sex and gender differences have been shown in other areas of sport development, however, there are few studies where these pathways of elite female athletes have been evaluated. We mapped the scope of the literature on this population, synthesizing measures of practice, play and specialization. We narrowed our scope to an elite sample, focusing on adult athletes at the varsity level or higher and youth athletes competing with national teams. An extensive search of the literature identified 1831 studies. Following screening, 32 studies were included that comprised all female participants or presented sex/gender disaggregated data. Retrospective methods were commonly used to quantify practice, play and specialization. National-level athletes were the most represented, although there was considerable heterogeneity in sport and expertise-level, making general or comparative judgements challenging. Early specializers were noted as accumulating high volumes of practice at a young age, particularly in soccer and gymnastics. These athletes deviated from predictions in the specialization pathway by continuing to engage in other sports in adolescence. Most groups in our sample followed diversified sport pathways before majority engagement in their primary sport. However, groups that showed more diversified sport profiles in childhood continued to participate in other sports in adolescence and early adulthood, sometimes with an increase in involvement, rather than the predicted decrease. In addition to highlighting the relative paucity of data pertaining to the pathways to expertise in female athletes, we show that the data from these groups deviates from predictions detailed in models of athlete development that are predominantly based on studies where the majority of athletes are male. Funding source: Funding for this project was provided by the Social Sciences and Humanities Research Council of Canada (Discovery grant awarded to NJH).

Does Dual-Task Practice Influence the Temporal Change of Attentional Demands of Sequence Representations?

Christina Pfeifer, Saarland University; Charles H. Shea, Texas A&M University; Stefan Panzer, Saarland University

An experiment was designed to investigate the attentional demands of a sequence representation. The primary task was a sequence of elbow extension/flexion movements with five reversal points. To measure the changes in attentional demand of a sequence representation, the secondary task was a manual simple reaction time probe task triggered either at the first, third or fifth reversal of the movement sequence. Participants ($N = 20$) were randomly assigned to a single-task (ST) or dual-task (DT)-practice group. On day 1, participants acquired the sequence task in 100 trials. The DT-group practiced the sequence task with the probe task. Day 2 consisted of a retention test and four inter-manual transfer tests. The mirror transfer test required the same pattern of muscle activation and joint angles in the contralateral limb as experienced during the acquisition phase, while in the non-mirror transfer test the visual-spatial locations of the target waveform were reinstated. Both transfer tests were conducted under ST and DT. The results of the acquisition phase indicated that all groups increased their performance across the acquisition session. No group differences occurred. The analysis of the reaction times of both transfer tests indicated that the ST- and DT-group responded slower at the first reversal compared to the fifth reversal. Overall, the DT-group performed with slower reaction times compared to the ST-group at the two transfer tests under dual-task. However, both groups performed the mirror transfer test with lower errors compared to the non-mirror transfer test. These findings suggest that the attentional demands of the visual-spatial and motor representation are higher at the beginning of the movement while they decrease towards the end of the response. Although the motor representation was responsible for movement execution, both visual-spatial and motor representation were vulnerable to DT interference at the beginning of the movement. In conclusion, DT practice does not influence the temporal change of attentional demands of sequence representations. Funding source: German Research Foundation (grant number: PA 774/13-1; SPP 1772).

The Effect of Attentional Focus on Postural Control in Older Adults During a 12-Week Balance Training Intervention

Louisa Raisbeck, The University of North Carolina Greensboro; Lauren Higgins, The University of North Carolina Greensboro; Jeffrey Labban, The University of North Carolina Greensboro; Ruth Stout, The University of North Carolina Greensboro; Jeffrey Fairbrother, Auburn University; Christopher Rhea, The University of North Carolina Greensboro

Including cognitive factors, such as attentional focus, may enhance fall prevention intervention training methodologies. An external focus (EF) of attention has demonstrated to be superior to internal focus (IF) for balance performance in older adults. However, it is unknown how use of EF vs. IF during longer duration balance training interventions impacts learning and performance. We examined the learning rate of older adults during a 12-week balance training intervention with attentional focus instructions. Adults ($N = 55$, 80.76 ± 6.07 years) who reported a fall during the prior 12 months completed balance training on wobble boards (20 x 30s balance, 30s rest) twice per week for 12 weeks with EF or IF instructions. Outcome measures [mean and standard deviation velocity and acceleration in the anterior-posterior ($MVELO_{AP}$, $MACC_{AP}$, $SDVELO_{AP}$, and $SDACC_{AP}$) and medial-lateral ($MVELO_{ML}$, $MACC_{ML}$, $SDVELO_{ML}$, and $SDACC_{ML}$) axes were collected following training session (24 time points) by a 35-second balance trial on an instrumented wobble board. Multilevel growth models were estimated to assess treatment effects on individual growth trajectories of the dependent variables during the training intervention. Significant group-by-time interactions were observed for $MVELO_{ML}$ ($\beta = 0.0001$, $p = .006$), $MACC_{ML}$ ($\beta = 0.007$, $p = .010$), $MACC_{AP}$ ($\beta = -0.008$, $p = .013$), $SDVELO_{ML}$ ($\beta = -0.006$, $p = .034$), and $SDACC_{ML}$ ($\beta = -0.004$, $p = .040$). The group-by-quadratic term interaction for $MACC_{AP}$ also approached significance ($\beta = 0.001$, $p = .066$). The fixed effect for time for $MVELO_{AP}$ ($\beta = 0.002$, $p = .001$) and $SDVELO_{AP}$ ($\beta = 0.002$, $p = .002$) reached significance, but the group-by-time interaction did not ($p > .05$). Neither the fixed effect for time ($\beta = 0.001$, $p = .323$), nor the group-by-time interaction ($\beta = -0.002$, $p = .243$) for $SDACC_{AP}$ reached significance. In older adults, an EF during balance training was beneficial for neuromotor control in the AP direction; however, neuromotor control decreased in the ML direction. This may suggest a positive compensatory mechanism used in this population. Funding source: NIH R15AG053866.

The Effect of Anterior Cruciate Ligament Injury on Global Motor Control Deficits

Keaton Reel, Utah State University; Anne Z. Beethe, Utah State University; Sara A. Harper, Utah State University; Breanna E. Studenka, Utah State University

Anterior cruciate ligament (ACL) injuries are some of the most common knee injuries for athletes (Frobell et al., 2010; Nicolini et al., 2014). Even after surgical reconstruction and rehabilitation, risk of re-injury to the same ACL is reported to be 23% (Ardern et al., 2014) and risk of contralateral ACL injury ranges from 3-49% (Barber-Westin & Noyes, 2011). Following ACL injury, afferent feedback is diminished which may lead to global changes in how the brain processes information and a deficit in controlling both the injured and potentially non-injured limb (Nyland et al., 2017). If ACL injury leads to global motor control deficits, impairment should be

evident, not only in actions produced by the injured leg, but also to actions produced by other limbs (e.g., the opposite leg, or the hand). The main goal of the proposed study was to test the effects of ACL injury on global motor control, specifically reaction time and response inhibition. Ten individuals (mean age = 21, *SD* = 2.4) with previous ACL injury and ten healthy controls (mean age = 23, *SD* = 5.1) were recruited to participate. Three tasks were designed to be administered via a remote protocol: simple reaction time, choice reaction time, and a go-no-go task designed to measure response inhibition. Preliminary evidence suggests that individuals with prior ACL injury had slightly shorter reaction time. No differences were seen in choice reaction time or response inhibition suggesting that those with prior ACL injury do not exhibit global impairment in response tasks.

Upper-Body Isometric Horizontal Strength in Professional Game Sport Athletes

Lukas Reichert, Goethe University Frankfurt; Björn Wieland, Goethe University Frankfurt; Marie-Therese Fleddermann, Goethe University Frankfurt; Karen Zentgraf, Goethe University Frankfurt

Side-to-side differences (DIFF) and their relationship with game sports performance (Bishop et al., 2017) and injury risk (Fort-Vanmeerhaeghe et al., 2020) have been a popular source of investigation in recent years. Although upper-body horizontal strength (UBHS) seems to play a crucial role in game sports performance (Gonçalves et al., 2021), DIFF have not yet been investigated in a whole-body-oriented setup. Therefore, the purpose was to study side aspects of UBHS in professional game sport athletes (GSA). Based on findings of DIFF in GSA (Bishop et al., 2017), we hypothesized DIFF in UBHS. In 106 GSA (w = 48), isometric UBHS (pushing horizontally with extended arms) was measured in three body positions (upright, slightly & clearly leaned forward), each in three body shifts (80% of body weight on left leg, 50-50, 80% on right). To detect differences between positions and shifts, a 3×3 repeated measures ANOVA was conducted for both the male and female group. Results showed a significant interaction effect (position; shift) for male, $F(4, 228) = 6.33$, $p < .001$, partial $\eta 2 = .10$, and for female GSA, Greenhouse-Geisser $F(3.40, 159.72) = 3.48$, $p = .01$, partial $\eta 2 = .07$. Post-hoc analysis revealed significant differences (Greenhouse-Geisser, $p < .001$) between all positions for male and female GSA. For body-shifted positions, post-hoc analysis showed significant differences for male, $F(2, 114) = 43.22$, $p < .001$, partial $\eta 2 = .43$, and for female GSA, $F(2, 94) = 9.31$, $p < .001$, partial $\eta 2 = .17$, with highest values in 50-50 positions and when shifted to the left in a clearly leaned-forward position for female GSA. Results indicate lower strength values for both male and female GSA when shifted to one side than when standing normally distributed. Interestingly, male and female GSA show higher values when shifted to the left compared to the right side in leaned-forward positions. Since many actions in game sports are performed laterally and/or shifted to one side, we suggest to tailor practice accordingly and to further study the role of DIFF in UBHS. Funding source: BISp.

Fine Motor Control Improved Following a Single Session of Cognitive Games in Adults With Down Syndrome

Shannon Ringenbach, Arizona State University; Nathaniel Arnold, Arizona State University; Kahyun Nam, Arizona State University

Research has shown that both motor and cognitive development are more related than recently thought. This connection has been verified in typical children and adolescents with DS in correlational studies. Thus, the purpose of this study was to compare three different interventions (i.e. resistance training, stationary cycling and cognitive games) to determine their effect on fine motor control in adults with DS. It was hypothesized that both exercise and cognitive interventions would improve fine motor control as measured by the Purdue Pegboard test. Fifteen adults (19 – 38 years, 5 female) completed three, 35 min interventions separated by at least 48 hours. 1) Assisted Cycle Therapy (ACT): pedals of a stationary bicycle moved approx. 35% faster than preferred cycling rate by a motor 2) Resistance Training (RT): 2 sets of 8-12 repetitions of 75% of participant's 1RM on stack-weight Machines of leg press, chest press, seated row, leg curl, shoulder press, and latissimus pulldown 3) Cognitive Training (CT): played board games involving counting (i.e., chutes and ladders). Fine motor control was measures by the Purdue Pegboard Test. Paired sample t-tests were conducted pre and post within each intervention. The results showed statistically significant improvements in left hand, both hands at the same time and total (right + left+ both) following cognitive training. One explanation for improvements from pre to post in cognitive training in fine motor control may be due to the fact that the prefrontal cortex has a role in cognitive function as well as motor function, which may attribute to the improved performance in fine motor control following cognitive training. There were no significant improvements following the exercise interventions, which may be due to both exercises focusing less on fine motor control. Our results are discussed with respect to their future implications for the benefits of different types of exercise for adults with DS.

The Effects of Differential Training on Learning in a Standing Broad Jump

Diego Rivera, Texas Christian University; Tanner Robinson, Texas Christian University; Adam King, Texas Christian University

The purpose of this investigation was to examine whether a differential, in comparison to a traditional, learning program facilitates the acquisition of a novel motor skill, a standing broad jump. Twenty-seven participants (8 males, 19 females, ages 21.8±1.4) were randomly assigned to either a differential ($n = 14$) or a traditional training group ($n = 13$). Participants completed pre- and post-training testing sessions (separated by eight days) that consisted of four maximum effort broad jumps with ground reaction forces recorded from a force plate (150 Hz) and up to 30 seconds of rest in between jumps. A total of four training sessions were completed for both groups and each session consisted of an active warm up and 20 repetitions of the standing broad jump task with up to 30 seconds of rest in between repetitions. The differential group performing 20 different variations of the standing broad jump while the traditional group executed the same jump pattern for all 20 repetitions. During the pre- and post-training testing sessions, jump distances were recorded. Jump performance was also assessed by two kinetic variables computed from the force plate – a bodyweight normalized vertical ground reaction force and a rate of force development. Results showed that differential training had greater jump distances than the traditional ($p < 0.05$) but there was no training effect found ($p > .05$). Similarly, normalized vertical forces were different between the groups ($p < .05$) and no training effect on peak ground reaction forces ($p > 0.05$). Overall, differential training did not show the expected performance enhancement in this discrete, explosive motor task. The lack of a training effect may be the result of limited training duration and potentially to participants reduced ability to produce maximal effort during the different jump variations. Further research is needed to better understand the tasks and factors where the movement variations associated with differential training influence skill acquisition.

Examining Focus of Attention Strategies for a Challenging Balance Task

Nicole Robak, University of Manitoba; Brian MacNeil, University of Manitoba; Steven Passmore, University of Manitoba

An external focus of attention (FOA) improves balance during simple tasks. Recent studies suggest FOA proximity and relevance further impact performance. The present study assessed different distances and relevance of external and internal FOA in a challenging balance task (slackline) to determine if the FOA effect remains. Novice participants ($N = 25$; 12 female, $M_{age} = 25.7$, $SD = 1.2$) maintained balance for up to 30s on a slackline. In random order, 35 trials were completed across five FOA instructions: 1) control (balance as long as possible); 2) relevant internal (minimize foot movement); 3) irrelevant internal (minimize head movement); 4) proximal external (minimize slackline movement); and 5) distal external (focus on a point on the wall). Trials began with participants on a slackline who, once stable, pressed a button to start a timer. Trial timing ended once participants lost balance, stepping down to the floor. The dependent variable balance time indicated performance. Data were analyzed using ANOVA, with post-hoc Student's T-tests to dissect locations of significant differences. A global main effect for FOA was found. External FOA instructions yielded longer balance times ($M = 10{,}249$ms, $SD = 6{,}653$) than an internal FOA ($M = 8{,}465$ms, $SD = 5{,}480$). Analyses exploring differing locations of internal and external FOA conditions revealed proximal external FOA (slackline; $M = 10{,}826$ms, $SD = 8{,}301$) yielded superior performance compared to task relevant (feet; $M = 8{,}121$, $SD = 6{,}043$) or task irrelevant (head; $M = 8{,}809$ms, $SD = 5{,}676$) internal FOA conditions. A task relevant internal FOA resulted in statistically significant reduction in balance times, compared to all other conditions (control, external proximal, external distal), except a task irrelevant internal FOA. In summary, for a complex balance task external FOA instructions result in longer balance time. Specifically, a proximal external FOA instruction optimized performance. A task relevant internal FOA yielded the worst performance. The strategies identified may be useful in the early learning of challenging balance tasks.

Emotion and Joint Action: Valence Associations Reflect Partner Performance Quality

John Roman, University of Florida; Christoper Janelle, University of Florida

Individual and shared emotions integrate among pairs of individuals as they coordinate to accomplish a shared goal, which is commonly known as joint action. Recent investigations using stimulus-response compatibility (SRC) outcomes have applied methods from evaluative response coding (ERC) to assess how emotion influences joint action through *valence concepts*. SRC approaches seek to identify the stimuli characteristics that either facilitate (yield faster) or debilitate (yield slower) responses, summarizing facilitation as stimulus-response (S-R) *compatibility*, and debilitation as S-R *incompatibility*. Whether the associations among valence concepts manifest in compatibility or incompatibility is tested in the key press speed of the Joint Go/NoGo Association Task (GNAT). Therefore, the GNAT tests *affective-SRC* through one's response time (RSPT). Herein, affective-SRC tested if RSPT performance created valence concepts. SELF & OTHER and GOOD & BAD are the concepts that are either compatible (e.g., SELF/GOOD) or incompatible (e.g., SELF/BAD) when associated together. Rather than describing the "SELF" and "OTHER" in such monikers, each individual was identified by their actual task RSPT (e.g., SELF: 515 ms and OTHER: 765 ms), and associated with GOOD and BAD concepts. As predicted, the SELF: RSPT concept was a pleasant association regardless of the performance speed of a partner. The OTHER: RSPT concept was instead a flexible association, indicated by compatibility bifurcating on a partner's performance speed, where a FAST partner was a pleasant concept, and a SLOW partner was an unpleasant concept. The Implicit Attitude Test confirmed the bifurcation was due to relative partner performance (FAST vs. SLOW) as pleasant and unpleasant concepts. Therefore, performance through a valence concept flexibly determined compatibility relative to how one's partner performed, creating affective-SRC. In sum, a successful joint action starts with selecting the correct response and that process draws valence from a partner's performance to help determine the appropriate action.

Potential Brain Activation Differences During Balance Task Using Attentional Focus Strategies

Sydney Rossback, University of North Carolina at Greensboro; Louisa Raisbeck, University of North Carolina at Greensboro

The incidence of falls and fall related injuries in older adults increases each year making it an important public health concern. Although balance interventions are in place, the effectiveness over a long term is low. The motor behavior literature has shown that introducing cognitive factors such as attentional focus maybe beneficial to programs that focus on maintaining and/or improving balance. Attentional focus is the direction that an individual focuses during a task. It has been split into an external focus of attention (EFA) and an internal focus of attention (IFA). An EFA has been found to be more effective in motor learning and control than an IFA for a variety of motor skills, including in the context of postural control. However, the neurological reasons as to why are not clear. The purpose of this study is to examine the areas of the brain using electroencephalography (EEG) that activate for different attentional focus instructions during a balance task. Due to the small sample size (N-3) this study takes on a case study approach to examine potential cortical activation differences between internal and external focus of attention during a difficult balance task. The balance task is the standardized BESS protocol of 6 tasks on a firm surface and on a foam surface, with increasing difficulty. Cortical activity measures in the Alpha (frontal region) and Beta (motor cortex region) bands will be examined in effort to investigate differences during attentional focus conditions using EEG. Anticipated findings from this study will serve as an underlying explanation of mechanistic differences between types of attentional focus. This will lead to better understanding and development of training and coaching techniques as well as improvements in motor learning and performance. Funding source: n/a.

Exploration of the Perceptual-Motor Workspace for the Task of Walking on a Treadmill is Highly Constrained

Daniel M. Russell, Old Dominion University; Kathleen S. Thomas, Norfolk State University; Steven Morrison, Old Dominion University

Despite the large number of degrees of freedom, humans display only limited variation in movement kinematics during regular walking. Our goal was to examine the range of variation in knee oscillations that could be produced under the instruction to walk variably. Twelve young healthy adults walked on an instrumented treadmill at their preferred walking speed, while sagittal plane motion of the knees was recorded using electrogoniometers. Participants were instructed to walk normally or variably. Due to concerns that the conditions may influence one another, participants walked for four 5 min. trials in the following condition sequence: normal, variable, variable, normal. Peak to valley amplitude and peak to peak period (duration) were computed for each knee oscillation. Regularity of knee motion was computed via Sample Entropy (SampEn). Normal walking results in a bimodal distribution of knee amplitudes, with a large amplitude during the swing phase and a small amplitude during the stance phase. Variable walking also results in a bimodal distribution of knee amplitudes, but with significantly more dispersion, quantified by standard deviations, for large and small amplitudes. Similarly, the variability of knee motion period was significantly larger under the variable instruction than for normal walking. Knee motion was highly regular (low SampEn) during normal

walking. Walking under the variable condition resulted in significantly reduced regularity (higher SampEn), but knee motion remained highly regular. No significant differences were found between the two normal trials or between the two variable trials, indicating performance of the conditions did not affect each other. Participants reported that walking under the variable condition was extremely "effortful" compared with normal walking. Young, healthy adults can perform a wider range of movement parameters than they typically prefer to, but the exploration of the perceptual-motor workspace for the task of walking on a treadmill is highly constrained.

Impact of Acute Aerobic Exercise on Golf Putt Skill Learning in Adults With Intellectual Disabilities

Yonjoong Ryuh, Sonoma State University; Chih-Chia Chen, Mississippi State University; Zhujun Pan, Mississippi State University; John Lamberth, Mississippi State University

As motor learning in individuals with intellectual disabilities (ID) has been poorly elucidated, this study aimed to apply an acute aerobic exercise (AE), well-known intervention favorable to motor learning in typically developing individuals, to assist people with ID in motor learning of a golf putting task. A total of 17 adults with ID (11 males, $M_{age} = 31.41 \pm 9.7$ years, & $M_{mental\text{-}age} = 7.69 \pm 3.06$ years) participated in this study. This was a within-subject counterbalanced study, and the participants went through two different interventions: vigorous treadmill walking (AE) and seated rest (CON) conditions, with having a month of wash-out period in between the interventions. Golf putting accuracy was assessed at pre-test, post-test, 24-hour retention, and 7-day retention test phases. A series of ANOVA was employed to capture each motor learning process including exercise-induced effect (pre vs. post), motor learning (pre vs. 24-hour), and motor memory consolidation (pre vs. 7-day). The results indicated that the golf putting accuracy in post-test was not significantly different from the pre-test. However, the putt accuracy had an interaction effect at 24-hour retention test phase compared to pre-test, $F(1, 32) = 5.26$, $p = .03$, $\eta p2 = .14$. A paired t-test then indicated a near significant improvement in putt accuracy in AE ($p = .07$), but not in CON condition ($p = .23$). The results between pre-test and 7-day retention phases did not indicate a significant effect on golf putt skill. Although not significant, the results indicated a trend that the AE positively influenced golf putt accuracy at 24-hour delayed retention phase, but not immediately after the intervention and 7-day retention phases. Given the small sample size and that the study procedure did not include multiple practice blocks, the observed effectiveness of AE on golf putt accuracy in adults with ID is promising; thus, a future study is recommended to further verify the effectiveness of AE on motor learning in individuals with ID. Funding source: N/A.

Effects of a Two-Week Imagery Intervention With Specific Uses of Attentional Focus Cues

Jack Sampson, New Mexico State University; Christopher Aiken, New Mexico State University; Phillip Post, New Mexico State University; Sean Cochran, New Mexico State University; Tatiana Zhuravleva, New Mexico State University

The effect of imagery on performance has been well established within sport psychology literature (Weinberg, 2008). One common manipulation is the inclusion of a kinesthetic sense, where focus is directed to the feeling of specific body movements (Vealey & Forlenza, 2021). This manipulation appears to be at odds with the motor learning literature, which suggests that focus needs to be on the effects of the movement (i.e., external focus) (Wulf, 2013). The present study serves as a continuation of a previous imagery study, where-in a single session standing long jump performance improved regardless of focus cue. It is possible that potential differences between focus cues were inhibited by the single session design, with it being suggested that imagery ability can be enhanced through practice (Anuar et al., 2013). It was hypothesized that an external focus cue would lead to further jump distances than an internal focus cue imbedded within a multiple-session imagery intervention. 17 participants volunteered and completed 5 sessions of imagery practice where they performed 10 jumps in each session, including a warm-up. Each participant completed a series of 3 jumps under each condition: control (CON), internal imagery (INT), and external imagery (EXT). Data was analyzed with a 3 (imagery) x 2 (pre-posttest) repeated measures ANOVA. The ANOVA revealed a main effect of condition ($p < .001$), with post-hoc analyses showing that INT and EXT conditions jumped significantly further than CON ($p < .001$). The findings suggest that imagery enhances performance regardless of which attentional focus type is imbedded within the imagery. This result provides support for PETTLEP imagery, with both internal and external foci being effective for standing long jump performance. The results are somewhat at odds with the attentional focus literature, as we anticipated superior performance following the external focus imagery. More research should be conducted to further examine the relationship between PETTLEP imagery and attentional focus.

History of Concussion Oddly Results in Greater Saccadic Accuracy

Gustavo Sandri Heidner, East Carolina University; Brittany Trotter, East Carolina University; Joshua Lawton, East Carolina University; Nicholas Murray, East Carolina University

Concussions are a type of traumatic brain injury resulting in short-lived to long-lasting neurological function impairment. Most of the symptoms disappear within fifteen days. However, recent data suggests that the complications go beyond the lingering neurological and psychological conditions. Motor control impairments are observable in concussed participants over one-year post-trauma. The present study examined the prevalence of ocular and hand motor control impairment in concussed participants over a longer range of time. We hypothesized that participants with a history of concussion would perform worse than non-concussed controls in a dynamic oculomotor control and hand motor control task in a virtual reality (VR) environment. Twenty-eight participants ($N = 28$, $M_{age} = 21.4 \pm 2.7$ years, 12 concussed) completed three trials each. Participants were fitted with eye tracker-embedded VR goggles. The experiment consisted of a constantly forward-moving corridor in which two types of targets would appear in random locations at select intervals of time. Participants were instructed to pull the trigger on the VR controller only when the correct target was observed. A proximity-to-the-target score of 1-10 was recorded. A Python 3.9.2 routine was used to extract gaze time lingering on target (LT), mean score (MS), saccadic accuracy (SA), visual reaction time (RTv), and motor reaction time (RTm). No differences were observed between groups in LT ($p = .229$), MS ($p = .546$), RTv ($p = .296$), and RTm ($p = .816$). Compared to controls ($M = 5.1$, $SD = 1.6$), concussed participants ($M = 6.3$, $SD = 1.2$) had better SA, $t(26) = -2.0$, $p = .049$, $d = .79$. These results suggest participants with a history of concussion perform equally to controls with no concussion history in most aspects of this dynamic task. However, on average, concussed participants had better saccadic accuracy when seeking the cue. More work is needed to explore this relationship between concussion and saccadic accuracy. Funding source: International Society of Biomechanics (MDG).

Reduced Stride Length as a Precursor to Developing Freezing of Gait in Parkinson's

Kishoree Sangarapillai, University of Waterloo; Aaron Geetan, Wilfrid Laurier University; Quincy Almeida, Wilfrid Laurier University

Freezing of gait (FOG) be is argued o be the most debilitating symptoms of PD. While the pathophysiology remains not well understood, several factors such as stride length and stride time may have the potential to serve as a precursor prior to the occurrence of FOG. Thus, it may be important to compare stride length and stride time among those who have never developed FOG against those who have developed FOG to see if there are differences in these gait variables. To do this, 458 participants were divided into two groups (PD+non-FOG=364) and (PD+developed-FOG=94). Next, stride length and stride time were retrospectively analyzed using gait data previously attained to identify any differences between both groups. All gait tasks involved 3 trials of walking in a straight line on a sensor carpet, and data was converged and standardized across 4 software (PKMAS, Gaitrite, APDM and Optotrack). Independent t-tests indicated that there was a significant difference in stride length ($t(456)= 5.938$, $p < .001$), where those in the PD+non-FOG group had a larger stride length (MD=16.525, SE=2.72) in comparison to those who developed FOG. However, there was no difference in stride time between the two groups. As only those who developed FOG experienced reduced stride length stride length may be a precursor to FOG. Future rehabilitative therapies should target stride length as that may serve as a potential biomarker for FOG.

Characterizing Ankle Position Sense in Healthy Aging

Jacquelyn Sertic, University of Minnesota; Jürgen Konczak, University of Minnesota

Intact ankle proprioception is crucial to maintain balance during stance and gait. Clinically, proprioception is tested by asking patients to detect the repositioning of a limb by a clinician, which yields only crude measures of proprioceptive function. At present, empirical data that characterize ankle proprioception in older adulthood are sparse and incomplete. The goal of this study was to objectively and precisely characterize ankle position sense, a modality of proprioception, in a healthy aging population. We used the Ankle Proprioceptive Acuity System (APAS) to quantify ankle position sense acuity. Participants placed their unloaded foot on the APAS platform. From a neutral joint position, the ankle is then passively rotated to two distinct ankle positions (a reference and a comparison). Subsequently, participants verbally indicated which position they perceived as more plantarflexed. The reference position was fixed at either 15- or 25-degrees plantarflexion. The comparison position was always larger than the reference and determined for each trial by an adaptive algorithm. A total of $N = 59$ participants (M: 24, F: 35) between the ages of 50-79 years were recruited. Ankle position sense acuity was quantified as the just-noticeable-difference (JND) threshold that corresponded to the 75% correct response rate and the interval of uncertainty (IU). Median JND was computed as 1.60° (range 0.26° – 5.14°) and median IU was 1.04 (range 0.63 – 2.09). We found no evidence that these two measures of position sense acuity changed across the age range. No significant sex differences were found. Weber-Fechner's law predicts the JND threshold as a measure of bias to increase with increasing stimulus size. However, for this cohort the values for JND and IU were similar between both reference positions. These data can be used as a normative data to compare the position sense of older adults with suspected proprioceptive impairment and to monitor therapeutic success of interventions targeting proprioception and balance function.

The Effects of Practicing in Virtual Reality on Learning in the Physical World

Andrew Shaw, University of Tennessee; Logan Markwell, University of Tennessee; Joei Velten, University of Tennessee; Julie Partridge, Southern Illinois University; Andrew Strick, University of Tennessee; Jared Porter, University of Tennessee

Research in the area of practice specificity proposes that transfer of learning is increased when practice and testing parameters are closely matched. Unfortunately, not all performance situations lend themselves to realistic representative practice environments. In some cases, such as disaster response, remote work, and contexts with scarce resources, it is either dangerous, prohibitively expensive, or simply not possible to practice how you expect to perform under real-world constraints. The growing capabilities of virtual reality may provide a solution. The aim of this study was to determine if practicing in a virtual environment resulted in transfer of learning benefits similar to practicing a motor skill in the real-world. To pursue this aim, we built two identical putting greens, one in an indoor lab setting and one in virtual reality. Participants ($N = 33$) were randomly assigned to either real-world or virtual environment practice groups. Each group performed the same practice in type and volume. Participants performed a retention and transfer test (respectively) following two days of practice. Post-test results showed performance and learning were not significantly different between the virtual reality group and the real-world group. These results are promising for the use of virtual reality training with the goal of enhancing real-world performance. These findings also suggest that we may need to reconsider the core principles of practice specificity. Specifically, a person may not have to physically practice a motor skill in the real-world to facilitate motor learning of a real-world task. Additional research is needed to verify these results in more representative tasks as well as explore the effect of virtual world fidelity and realism on learning.

Does Perceived Physical Skill Level Predict Performance of the Same Task in the Real-World or Virtual Reality?

Andrew Shaw, University of Tennessee; Logan Markwell, University of Tennessee; Andrew Strick, University of Tennessee; Joei Velten, University of Tennessee; Julie Partridge, Southern Illinois University; Porter Jared, University of Tennessee

From a practical point of view, feeling confident in your own ability is often touted as a valuable predictor of future performance. Conversely, motor learning research has demonstrated that confidence in one's perceived skills is not a reliable predictor of future performance. This study set out to investigate if perceived skill capability of a real-world task provided any predictive value on performance of that same task either in the real-world or in virtual reality. The research team built two identical putting greens, one in an indoor lab setting and one in virtual reality. Participants ($N = 33$) were asked to assess their perceived skill at putting a golf ball prior to being randomly assigned to either a real-world or virtual environment practice group. Each group performed the same amount of practice in either virtual reality or in the real-world. Participants performed a retention and transfer test (respectively) following two days of practice. Results showed no correlation between perceived skill capability and performance on the real-world putting task. That is, participants were not able to accurately predict how skilled they were at putting a golf ball in the real-world. Additionally, we observed a significant negative correlation between perceived skill and performance on the virtual reality putting task. In general, the higher a participant perceived his/her putting skill, the lower his/her putting accuracy in virtual environment. Given that practicing in VR resulted in similar learning and performance improvements compared to practicing in the real-world, this negative correlation with perceived skill was unexpected. As with the contextual interference effect, poor performance in VR did not result in poor transfer to the real-world task. Therefore, when using VR practice to improve real-world performance, it may be important to inform the learner that they are likely learning despite possible poor VR practice performance. Further study is needed to verify these results and determine possible rationale.

Motor Control Moderate the Relationship Between Implicit Learning and Motor Ability in Children With Autism Spectrum Disorders

Bo Shen, Wayne State University; Liangsan Dong, Central China Normal University; Yanli Pang, Central China Normal University; Patricia Lasutschinkow, Eastern Michigan University; Jiayou Shen, University of Michigan; Jin Bo, Eastern Michigan University

Difficulty with implicit learning plays an important role in symptomology of Autism Spectrum Disorder (ASD). The findings in the motor learning literature, however, have been controversial. Additionally, how the learning impact motor deficits in ASD remains largely unknown. This study evaluated implicit sequence learning and its relationship with motor ability in children with and without ASD. Twelve children with clinical diagnosis of ASD and 16 age- and gender-matched controls performed a classic serial reaction time task (SRT), a retention task, and two explicit awareness tasks. Their motor ability was measured with the Movement Assessment Battery for Children (MABC). Significant learning differences between children with and without ASD were only found in retention ($t_{(26)} = 2.09$, $p < 0.05$) but not at the end of SRT. Neither SRT learning nor retention outcomes were correlated with MABC-2, although SRT baseline response time (RT) was associated with MABC (r =-0.43, $p < 0.05$). We further conducted exploratory moderation analyses with *baseline RT* as the moderator (M), *SRT retention* as the independent variable (X), and *MABC* as the outcome variable (Y) to test how the motor control impact the relationship between implicit learning and motor ability in both children with and without ASD. The model's explanatory power significantly increased with additional interaction term ($\Delta R^2 = 0.15$, $F = 4.61$, $p < .05$): children with faster RT had significant relationship between implicit learning and motor ability ($t = 1.97$, $p = .05$) whereas those with slower RT did not show any relationships. We argue that children with ASD may have more difficulties in consolidation rather than learning per se. Consistent and fine-tuned movements are fundamental for optimal learning and should be weighted more for future intervention in children with ASD.

Gait Variability in the Assessment and Tracking of Fall Risk in Older Adults

Ben Sidaway, Husson University

Two studies were conducted to examine the ability of measures of gait variability to assess the fall risk of healthy community dwelling older adults and then to determine whether dynamic balance training can improve those measures of gait variability. In the first study, gait parameters of 50 community dwelling older adults (65-95 yrs.) were recorded as they walked freely on a computerized mat. Participants also completed the Narrow Path Walking Test (NPWT) on the mat. The number of falls 6 months prior and 6 months post testing was recorded. Gait velocity did not differ between older adults who had fallen (F) in the previous 6 months and those who had not fallen (NF). No differences between F and NF were found for step length and step time but the NF group had significantly lower coefficient of variation (CV) in these gait parameters than the F group. Prior history of falls was significantly correlated with step length CV and step time CV. Analysis of the NPWT also found significant differences in step length and step time CV between the F and NF groups. In the second study, 13 older adults (65-90 yrs.) participated in a training study in which they attempted to walk along a series of 6 m beams of decreasing width (18, 15, 12, 9, 6 cm). Participants practiced beam walking for 20 minutes twice a week for 4 weeks. Before training, at the completion of training, and one week following training gait parameters were recorded on a computerized mat. All participants showed improvement in beam walking performance with practice. The balance training significantly increased self-selected gait velocity (0.78 m/sec to 0.88 m/sec) and step length (44.6 cm to 48.2 cm). Step length CV decreased significantly with training (13% to 8.7%) as did stride width CV (51% to 31%), and step time CV (7.3% to 5.5%). Taken together these studies indicate that measures of gait variability may be useful in identifying relatively healthy older adults at risk of falling and that dynamic balance training can reduce gait variability and potentially therefore, the risk of falls in older adults. Funding source: Husson University Research Fund.

Autonomy Supportive, Externally Focused Instructions Improve Children's Motor Learning in Physical Education

Thomas Simpson, Edge Hill University; Mitchell Finlay, Edge Hill University; Paul Ellison, Edge Hill University; Evelyn Carnegie, Edge Hill University; Victoria Riding, Preesall Fleetwood's Charity Primary school; David Marchant, Edge Hill University

Practice conditions that facilitate an external focus (EF) of attention and support learner autonomy (AS) have been shown to improve motor performance and learning. However, research has yet to examine how the delivery of EF instructions impacts motor learning (i.e., via autonomy supportive or controlling instructions). Therefore, the present study examined the effects of delivering EF instructions via autonomy supportive vs controlling instructional language. Twenty-four novice participants (10.30 ± 0.52yrs) practiced a land-based curling task under AS-EF (EF instructions delivered via supportive language), AC-EF (EF instructions delivered via controlling language) or control conditions (EF instructions-only) before completing a same-day retention and transfer test (non-dominant hand). Participants were required to push a curling-stone from 5m towards a bullseye target. An EF was promoted by instructing participants to "slide the stone smoothly to the centre of the target". Task instructions included autonomy-supportive (i.e., provide choice or hints for successful task completion which could be adopted or rejected by the participant) or controlling language (i.e., prescribed how best for the participant to successfully complete the task) for the AS-EF and AC-EF groups respectively. Motor performance was measured via a points-based accuracy score (Max score = 10) and positive affect was measured post-practice on a 200-point continuous scale. ANOVA revealed the AS-EF group (Mean = 3.68 ± 2.00) outperformed the AC-EF (Mean = 1.23 ± 1.09; $p = .002$) and control (Mean = 1.52 ± 1.07; $p = .007$) groups on the retention test and reported higher positive affect after practice. The findings support predictions of the OPTIMAL theory and further evidence that EF and AS factors have additive effects on children's motor learning. Moreover, results suggest that the detrimental effects of controlling instructional language can be offset by an EF, indicating that positive motivational interventions facilitate an optimal focus of attention through goal-action coupling mechanisms.

Functional Variability Increases With a Distal External Focus

Harjiv Singh, University of Nevada, Las Vegas; Hui-Ting Shih, University of Nevada, Las Vegas; Elmar Kal, Brunel University; Tim Bennett, Leeds Beckett University; Gabriele Wulf, University of Nevada, Las Vegas

A recent meta-analysis on attentional focus (Chua, Jimenez-Diaz, Lewthwaite, Kim, & Wulf, 2021) showed that focusing on an intended movement effect that is farther away from the body (i.e., distal external focus) results in performance benefits relative to focusing on an effect in greater proximity to the body (i.e., proximal external focus) or the body itself (i.e., internal focus). The present study examined whether this distance effect was associated with differences in functional variability. Skilled volleyball players ($n = 20$) performed sixty overhand volleyball serves to a target. Using a within-participants design, an internal focus ("Focus on your hand"), proximal external focus ("Focus on contacting the middle of the ball"), and

distal external focus ("Focus on hitting the bullseye) were compared. The distal focus condition resulted in significantly higher accuracy scores than did the proximal and internal focus conditions. To examine whether this was a result of increased functional variability, 3D kinematic data were collected by a 12-camera VICON motion capture system, and the uncontrolled manifold analysis (UCM) was used. Shoulder, elbow, and wrist joint angles served as elemental variables whereas the magnitude and angle of ball velocity was calculated as the performance variable. In line with our hypothesis, functional variability was greatest in the distal focus condition as shown by a significant increase in V_{UCM} (performance-stabilizing variance) and significant decrease in V_{ORT} (performance-destabilizing variance) compared to the proximal and internal focus conditions. These findings suggest that a distal external focus on the task goal enhances movement outcomes by optimizing compensatory coordination of body parts.

Determining Fall Risk in Older Adults: A Novel Balance Task With a Cost-Effective, Portable Phone App

Ruth Stout, University of North Carolina at Greensboro; Lauren Higgins, University of North Carolina at Greensboro; Christopher Rhea, University of North Carolina at Greensboro; Louisa Raisbeck, University of North Carolina at Greensboro

Research shows that falls are more common after age 65, which can result in injury, loss of independence, and mortality. Clinical fall assessments are typically not administered until a fall occurs, eliminating intervention. This study aims to identify balance tests that may indicate higher fall risk for older adults; by comparing them with younger adults when performing a novel balance test. A smartphone app was developed to measure the temporal and spatial characteristics of the right leg during a stepping in place task. The test is cost effective, and is easy to administer. It was hypothesized that mean stride time and variability would be less in younger adults but that they would demonstrate greater excursion and height (thigh ROM, mean peak flexion) for each stride. Ninety-nine younger adults (18-30 years) were recruited in a multi-site project, and compared with 19 older adults from 65-90 years (78±6.01) who reported that they had not experienced a fall in the previous 12 months. Participants stepped to a timing cue delivered by the phone app for ten seconds, followed by an additional 60s at that recalled pace while shaking the head, challenging the vestibular system. Three trials were completed, and averaged for each variable. A multi-level model was conducted to compare the effects of group on spatial variables (thigh ROM, mean peak flexion, SD of peak flexion, COV of peak flexion) and temporal variables (mean stride time, SD stride time, COV stride time). There were no group differences for steps. The younger group was coded 0, and the older group 1. A significant effect of group was observed for stride time COV ($\beta = 2.634$, $p < .001$), thigh ROM ($\beta = 36.298$, $p < .001$), mean peak flexion ($\beta = 40.32$, $p < .001$), and COV of peak flexion ($\beta = 7.782$, $p < .001$) There are group differences captured by the phone suggesting that older adults sacrificed the ROM of the thigh to keep the pace. We conclude that better clearance of the legs in stepping could help mitigate fall risk, and is supported in literature of stair climbing and obstacle clearance. Funding source: NIH/National Institute on Aging Grant 1R15AG053866.

How Similar is Immersive Virtual reality to the Real-world? A Pilot Cross-Over Design on Upper Limb Kinematics

Andrew Strick, University of Tennessee, Knoxville; Logan Markwell, University of Tennessee, Knoxville; Kaileigh Ester, University of Tennessee, Knoxville; Jared Porter, University of Tennessee, Knoxville

Previous research has demonstrated motor learning benefits when using virtual reality (VR) practice environments that simulate replicate real-world (RW) tasks/contexts have demonstrated motor learning benefits in a RW context. Numerous studies have examined how varying aspects of VR affect motor performance. However, understanding the degree to which the biomechanical fidelity can differ in VR compared to the RW is warranted. The purpose of this pilot study was to determine if upper limb joint kinematics differences exist between VR and RW practice for a dart throwing. Kinematic data were obtained using 12-camera 3D motion capture system (Vicon Nexus Motion Analysis Inc., UK). Two male participants performed 130 dart throws in a single practice session in a cross-over design of 5 conditions: pre-test, RW practice, mid-test, VR practice, post-test. A total of 50 dart throws were performed in each practice phase and 10 dart throws were performed during the pre-test, mid-test, and post-test (the first 9 of which were recorded in each condition). A cross-over design was implemented between the RW and VR practice conditions to minimize possible order effects. Dependent measures taken were minimum and maximum elbow angle, elbow angular velocity, and wrist linear velocity. Data were analyzed using 5 one-way ANOVAs. The results of the ANOVAs indicated that there was a significant effect between conditions for only elbow angular velocity and wrist linear velocity. Post-hoc Scheffe tests revealed statistically significant differences in elbow angular and wrist linear velocity from VR practice compared to all other conditions. Specifically, these results showed elbow angular and wrist linear velocity were significantly lower in VR compared to RW. The results of this study indicate dart throwing practice in immersive VR has significantly different upper limb joint kinematics compared to RW, which could limit the transfer between VR to RW tasks. This finding should be taken under consideration for the implications it may have on transfer of learning from VR to RW.

The Influence of Spectators on NBA Free Throw Shooting Performance

Andrew Strick, University of Tennessee, Knoxville; Logan Markwell, University of Tennessee, Knoxville; Harjiv Singh, University of Nevada, Las Vegas; Jared Porter, University of Tennessee, Knoxville

Previous research demonstrated a significant increase in free throw shooting accuracy as the National Basketball Association (NBA) finished the 2019/2020 season inside the NBA bubble without spectators. Interestingly, the average free throw shooting percentage in the NBA has been 75% for nearly five decades. However, during the 2019/2020 season without spectators, the free throw percentage significantly increased to 79%. Two regular NBA seasons have now been played with spectators present since the 2019/2020 spectator-free NBA bubble season. The current study examined differences in free throw percentage between the 2019/2020 COVID-bubble season played without spectators and the most recent two NBA seasons played with spectators. This study also examined differences in free throw percentages between home and away games to understand if a possible home-field advantage contributed to this increased free throw percentage phenomenon. Chi-square tests of independence were used to test for significant differences in the percentage of free throws made. Analyses revealed free throw shooting percentages during the 2020 and 2021 NBA seasons (with spectators) were significantly lower compared to the spectator-free season. While the free throw shooting percentage increased to 79% directly following the removal of spectators, the free throw shooting percentage decreased back to the average (i.e., ~75%) that has been observed for the last fifty years during the 2020 and 2021 spectator-filled NBA seasons. Moreover, the analyses found no differences in free throw percentages between home and away games. Given that no differences were found between home and away free throw shooting percentages, home-field advantage does not appear to have an influence on the increase in free throw shooting accuracy inside the NBA bubble. Thus, the differences in free throw performance are likely due to factors

including the environmental characteristics shaped by the lack of fans that could contribute as a moderator to athlete's arousal levels playing inside spectator-free arenas.

Increased Memory Use in Müller-Lyer Tasks Reduces Perceptual Bias

Ganesh Tailor, University of Manitoba; Cheryl Glazebrook, University of Manitoba

The Müller-Lyer illusion (ML) produces biases in size estimation where the in-arrows figure is perceived as longer than the out-arrows figure. Varying the details of a ML task alters the magnitude of bias experienced. For example, action is purportedly less susceptible to illusions than perceptual tasks, but if the reliance on memory is increased then the illusory bias during a grasping task increases. The present study varied the perceptual task details by comparing illusory biases when ML figures were viewed concurrently (CON) and successively (SUC). Thirty adults completed two blocks of 184 trials in each of the CON and SUC conditions. In the CON condition participants indicated by keypress whether the central line of the ML figures on the left or right side of the screen was longer. In the SUC condition, they indicated by keypress whether the figure presented first or second contained the longer line. Increased bias was defined by an increase in incorrect responses, longer response time (RT), and greater standard deviation of response time (RTSD) with ANOVAs conducted to determine differences between conditions. Incorrect responses were higher in CON ($M = 55.8 \pm 2.29$) relative to SUC ($M = 47.2 \pm 3.48$). CON RT ($M = 587\text{ms} \pm 13.5$) was longer than SUC ($M = 357\text{ms} \pm 14.4$), whereas CON RTSD ($M = 116\text{ms} \pm 4.05$) was smaller than SUC ($M = 357\text{ms} \pm 14.4$). Therefore, increased ML susceptibility was evident in the constant vision CON condition, relative to the reduced bias of the SUC condition, when memory of the prior figure was necessary. Vision-for-perception and memory-guided action are both considered ventral stream processes. While memory-guided action tasks reportedly produce increased illusory effects, we found memory in a perceptual task instead decreased the illusory effect. Thus, the degree to which a visual illusion leads to bias appears to depend on task details that go beyond a perception-action dichotomy. Future research will vary the presentation and response details to further elucidate the relationship of vision availability and visual stream utilization in illusion tasks. Funding source: National Sciences and Engineering Research Council of Canada.

Chaotic Practice Schedules Create More Orderly Responses: A Paradoxical Secondary Analysis

Sarah Taylor, University of Utah; Bradley Fawver, University of Utah; Joseph L. Thomas, University of Utah; A. Mark Williams, Institute for Human and Machine Cognition; Keith R. Lohse, Washington University School of Medicine

Contextual interference is one of the most established effects in motor learning research; random practice is associated with poorer performance (in the short-term) but superior learning (in the long-term), when compared to blocked practice. However, the way this interference affects learners on a trial-to-trial basis remains less understood. We present a secondary data analysis of N=84 healthy young adults, replicating the contextual interference effect in a time estimation task. We used the determinant of a correlation matrix to measure the amount of order in participants' responses. The determinant is conceptually equivalent to the unexplained variance (1-r^2) but applies to higher dimensional spaces. We calculated this determinant in two different phase spaces: (1) Trial Space, which was the determinant of the previous 5 trials (lagged constant error 0-4); and (2) Target Space, the determinant of the previous 5 trials of the same target. The distinction in phase space is critical because for blocked practice the previous trial is almost always the same target, but for random practice the previous trial is almost never the same target. In Trial Space, there was no significant difference between groups (p=0.98) and no Group x Lag interaction ($p = 0.54$), although there was an effect of Lag ($p < .01$). In Target Space, there were effects of Group ($p = 0.02$), Lag ($p < .01$), and a Group x Lag interaction ($p = .03$). Participants who practiced using random schedules showed smaller determinants overall, which got smaller as more past trials were included (i.e., increasingly ordered responses). This order was due to the random group having positively correlated errors from trial-to-trial in Target Space. This "response inertia" in the random practice group suggests a greater reliance on the retrieval of the target from memory. Our novel analysis supports the reconstruction account of the contextual interference effect and helps integrate the effect with other learning principles in psychology (e.g., retrieval practice being beneficial for long-term recall). Funding source: NA.

Longitudinal Decline in Purdue Pegboard Performance in Parkinson's Disease

Emily R. Tobin, University of Florida; Bradely J. Wilkes, University of Florida; David J. Arpin, University of Florida; Michael S. Okun, University of Florida; Michael S. Jaffee, University of Florida; Nikolaus R. McFarland, University of Florida; Daniel M. Corcos, Northwestern University; David E. Vaillancourt, University of Florida

Purdue Pegboard Test (PPT) is objective, inexpensive, and has high test-retest reliability. Although PPT has been studied longitudinally in Parkinson's disease (PD), there has not been a control group to determine if the change is associated with aging or degeneration related to PD. In addition, quantitative kinematic recordings characterizing why the PPT may be impaired in PD is unavailable. The goals of this study were: 1) assess longitudinal changes in PPT between PD and healthy controls (HC), and 2) assess the use of triaxial accelerometry during PPT to characterize kinematic motor deficits in PD. Participants included 164 PD and 53 HC participants collected from two sites. Each participant performed PPT at baseline and 1-year. The PPT includes four specific tasks: dominant hand (DH), non-dominant hand (NDH), both hands (BH), and assembly task (AT). In a subset of participants (20 PD/19 HC), triaxial accelerometers were placed on the left hand (LH), left brachioradialis (LB), right hand (RH), right brachioradialis (RB), and head (HD), to compare cross-sectional changes in kinematics during PPT. The change in PPT had a significant interaction between diagnosis and time for the DH [$F(1,211) = 8.16$, $p < .01$] and BH tasks [$F(1,211)=13.9$, $p < 0.001$]. Over 1-year, there was a significant decline in PPT ($ps < .001$) in DH and BH tasks for PD, but no changes were observed for HC. In the accelerometer recording compared with HC, PD patients had a reduced standard deviation of acceleration for the RH, RB, and HD sensors during the DH task ($ps < .001$), LH, LB, and HD sensors during the NDH task ($ps < .05$), and all sensors for BH task and AT ($ps < .05$). Approximate entropy increased for PD compared to HC at the LB, RH, RB, and HD sensors during the DH task ($ps < .05$), LH, LB, and HD sensors during the NDH and BH tasks ($ps < .05$), and LB, RB, and HD sensors during the AT ($ps < .05$). PPT declines over 1-year of disease progression in PD, beyond that of normal aging. PD have more variability and increased entropy in the acceleration during PPT performance. Funding source: R01 NS052138, R01 NS058487, U01 NS102038.

Dual-Task Training Improves Performance and Retention of a Complex Postural Control Task in Healthy Young Adults

Brittany Trotter, East Carolina University; Chia-Cheng Lin, East Carolina University; Brian Sylcott, East Carolina University; Swati M. Surkar, East Carolina University

Dual-task (DT) refers to the simultaneous performance of a cognitive and motor task. While previous studies indicate that competing cognitive-motor resources in DT performance deteriorates task performance, there are limited studies on how DT training of a complex postural control task affects DT performance and performance of the motor task alone. Given the frequency of DT performance in daily life, it is vital to explore this relationship. The present study examined the effects of a 1-week complex dynamic stability DT training paradigm specifically on motor task performance during DT and single task (ST) performance. We hypothesized that following the 1-week training paradigm, motor task performance would improve in both DT and ST, with lasting improvements in both tasks at a 1 week follow up visit. The DT paradigm consisted of a balance task (motor), using a dynamic stability platform, combined with an auditory reaction time (RT) task (cognitive). The RT task included both a simple (one stimulus, one response) and choice (two stimuli, two responses) condition. DT and ST performance were assessed by the average amount of time (s) spent in, and within 3 degrees of, the center of the stability platform. Time spent left and right of the center were also assessed. During testing, participants ($n = 18$) performed each task 6 times in a block paradigm (30s task, 30s rest). DT training consisted of 18 DT trials per day for 5 consecutive days. Average changes in motor task performance during DT and ST were assessed pre-, post-training, and one week following post-training. Significant differences were found in left, right, and center times across multiple phases (DT and ST each during the simple and choice RT phases of testing) and time points of testing, indicating significant improvement in motor task performance regardless of performing DT or ST. Moreover, center time significantly improved from pre-training to follow up testing in all phases of testing (all $p < 0.001$), indicating retention of the motor task, even though it was only practiced during DT training.

The Effects of Virtual Reality Practice on Engagement and Performance

Joei Velten, University of Tennessee, Knoxville; Logan Markwell, University of Tennessee, Knoxville; Andrew Strick, University of Tennessee, Knoxville; Andy Shaw, University of Tennessee, Knoxville; Jared Porter, University of Tennessee, Knoxville; Julie Partridge, Southern Illinois University, Carbondale

Previous studies utilizing immersive virtual environments in practice have demonstrated transferable improvements in real-word motor performance. One possible explanation for these effects is an increase in user engagement as a product of practicing in virtual reality (VR). To fully understand the scope of VR as a practice tool, it would be valuable to understand how VR impacts engagement during the skill acquisition process. Therefore, the purpose of this study was to compare engagement and performance between VR and real-world practice groups for the same motor skill. It was hypothesized that engagement would be higher when practicing the task in VR compared to practicing the same task in the real-world. Participants ($n = 33$) were randomly assigned to either a VR ($n = 18$) or a real-world practice condition ($n = 15$) in which they performed a miniature golf putting task. On the first day, participants completed an engagement scale questionnaire, performed a 10-trial pre-test, performed a 50-putt acquisition phase, and completed a second engagement scale questionnaire following the acquisition phase. Participants returned on the second day to perform a 10-trial post-test. A 2 (condition) x 2 (test phase) repeated measures ANOVA indicated that the level of engagement was not significantly different between the two practice conditions. Further analysis revealed that both conditions showed a statistically significant ($p = .021$) improvement in accuracy (i.e., radial error) from pre-test to post-test, but the two practice groups did not differ from one another. An additional analysis for performance showed that there were no significant changes in precision (i.e., bivariate variable error). While these results did not fully support our initial hypothesis, they suggest that motor skill practice in VR is equally effective as real-world practice at facilitating motor learning.

Combining Self-Controlled Practice and Attentional Focus Effects Performance

Joei Velten, University of Tennessee, Knoxville; Logan Markwell, University of Tennessee, Knoxville; Andy Shaw, University of Tennessee, Knoxville; Andrew Strick, University of Tennessee, Knoxville; Jared Porter, University of Tennessee, Knoxville

Previous studies have demonstrated positive performance effects associated with self-controlled practice and adopting an external focus of attention. Work is needed to gain a better understanding of how these two constraints interact with one another. Therefore, the purpose of this study was to compare performance between a self-controlled practice group and a yoked practice group for the same skill. It was hypothesized that the self-controlled practice group with an external focus of attention would jump the furthest distance and the yoked condition instructed to focus their attention internally would jump the shortest distance. Participants ($n = 18$) were randomly assigned to a self-control group ($n = 9$) or yoked group ($n = 9$) in which they performed a standing long jump task. All participants completed a total of 10 jumps. The self-control group was given the choice of which attentional cue they wanted to focus on prior to each jump. Participants in the yoked group were instructed how to focus their attention (i.e., internally or externally) prior to each jump. A 2 (condition) x 2 (group) repeated measures ANOVA was conducted to evaluate potential performance differences. Although the statistical analysis was underpowered, it revealed marginal group differences. In support of our hypotheses, the self-controlled/external focus group jumped the furthest while the yoked/internal focus group displayed the worst performance. Interestingly, the self-controlled/internal focus group and the yoked/external focus group resulted in nearly identical performances. It would be beneficial for future studies to continue this research to better understand how the focus of attention and self-controlled practice effects interact with one another. Thus, future research is needed to develop effective practice strategies and to further develop our understanding of the skill acquisition process.

The Consolidation Mechanisms of Implicit Motor Adaptation and Sequence Learning

Yiyu Wang, Texas A&M University; Angelina Huynh, Texas A&M University; Emily Richardson, Texas A&M University; Shancheng Bao, Texas A&M University; David Wright, Texas A&M University; Yuming Lei, Texas A&M University

As one learns a new motor skill, the individual is acquired to precisely identify and execute an appropriate sequence of motor actions (motor sequence learning) and rapidly adjust sensorimotor mappings of learned actions in constantly fluctuating environments (motor adaptation). The learned sequence of actions and the adapted pattern continue to be processed by the brain after practice has ceased. This study aimed to investigate the behavioral and neurophysiological signatures associated with the offline processes of sequence learning and motor adaptation. We first showed that the initially fragile memories formed during sequence learning and motor adaptation were transformed into robust and stable memories during the offline processes. Notably, those memories associated with two motor skills follow diffident consolidation processes. We then demonstrated that interfering with the primary motor (M1) and sensory (S1) cortex using continuous theta-burst stimulation impeded the consolidation processes of two motor skills. Our results reveal the key mechanisms that encode memories of sequence learning and motor adaptation during the offline processes.

Proximal and Distal Muscle Activation Differentially Affect Bimanual Coordination

Yiyu Wang, Texas A&M University; Osmar Neto, Anhembi Morumbi University; Madison Weinrich, Texas A&M University; Roberto Castro, Texas A&M University; Traver Wright, Texas A&M University; Deanna Kennedy, Texas A&M University

Previous research has indicated that neural crosstalk is asymmetric in nature with the dominant limb exerting a stronger influence on the non-dominant limb than vice versa. Recently, it has been hypothesized that this influence is stronger for proximal than distal muscles. The current investigation was designed to determine the effects of proximal (triceps brachii (TBI)) and distal ((First Dorsal Interosseous (FDI)) muscle activation on bimanual coordination. Twelve right-limb dominant participants (mean age = 21.3) were required to rhythmically coordinate a 1:2 pattern of isometric force guided by a Lissajous plot. Participants performed 10, 30 s trials for each muscle group (TBI's, FDI's). EMG-EMG coherence between each muscle group was calculated using wavelet analysis. The results indicated that participants could effectively coordinate the 1:2 multi-frequency force pattern with both TBI and FDI muscle groups. However, participants were more temporally accurate when performing the task with their FDI muscles than TBI muscles. The force distortion quantified by harmonicity indicated that more perturbations occurred in the left limb than the right limb. Interestingly, a significantly lower harmonicity in the left TBI muscle indicated the left TBI muscle was exposed to a greater extent to bimanual interference. As a measure of common neural inputs, EMG-EMG coherence indicated significant bilateral communication was occurring in the Alpha band (5 – 13 Hz), with a higher value observed in the TBI condition. The current results support the notion that neural crosstalk exerts an asymmetric influence, and such influence was inversely correlated with the extent of distortion observed in the left-limb force time-series. The results also indicated that this influence was greater for proximal than distal muscles and was occurring at a subcortical level.

Monkey See Monkey Do – A Study of Action Observation in Children With Developmental Coordination Disorder

Griet Warlop, Ghent University; Emiel Cracco, Ghent University; Frederik J. A. Deconinck, Ghent University

Children with Developmental Coordination Disorder (DCD) experience substantial difficulty to learn motor skills, to the extent that it significantly impacts their daily functioning. Motor learning is a result of strong associations between motor representations and the sensory consequences of motor actions. Due to these strong sensorimotor connections, observing a motor action primes the motor representation of that action. In DCD, it is hypothesised that the motor learning difficulties are related to deficient motor representations. Therefore, we aimed to examine the integrity of this low-level mechanism of action observation in DCD. Two experiments were used to test the extent to which observation of a motor action triggers internal action representations in children with and without DCD (age range: 10-14). Using an automatic imitation task, the direct influence of simultaneously executing motor actions while observing incompatible movements was tested. In an apparent biological motion task, it was tested whether sequences of static body postures were perceived as biological movement. In both tasks, EEG informed us about the neural responses related to action observation. Preliminary results in a sample of 7 typically developing and 7 children with DCD indicate similar automatic imitation effects between the groups. However, the EEG indicated lower P3 amplitudes in DCD, suggesting lower engagement in the cognitive processes related to distinguishing the externally triggered motor representations and the executed motor action. The apparent biological motion task informed us that children with DCD bind successive body postures into a continuous movement percept to an equal extend as their peers, indicated by similar neural responses between the groups. In conclusion, in search of the underlying mechanisms of the motor learning problems in DCD, it was found that automatic imitation is preserved in children with DCD and when observing successive static body postures they do perceive them as biological movement.

Accuracy of Dance Movement Learned From an Instructional Video

Emily Weber, Sam Houston State University; Jennifer Didier, Sam Houston State University

Dance, traditionally taught in studio settings (mirror, barre, music, & instructors), recently expanded to teach dance virtually. Platforms (ex: YouTube, MINDBODY, Zoom, and those proprietary to online dance education) are used; however, support for, and success in, virtual learning remains varied (Brooks, 2014; Eaves et al.; 2011; Kico et al, 2020; Parrish, 2008). The speed of the video was not found to make a difference in learning (Lelievre, et al, 2021) and differences in skill level and learning approaches among jazz dancers found more advanced dancers have developed strategies to remember movement more effectively than those less skilled (Poon & Rogers, 2000). Observational learning can occur in person or video (Mierowsky, 2019); however, are the studio and virtual settings equally effective in teaching dance? The aim of this study was to examine the differences among a counterbalanced mix of 16 intermediate and advanced dancers learning choreography in one of three settings: online with instruction facing the camera (Group 1: $N = 5$, $M_{age} = 14+2$, $dance_{yrs}$ $M = 8+4$), online with instruction facing away from the camera (Group 2: $N = 6$, $M_{age} = 13+2$, $dance_{yrs}$ $M = 7.5+3$), and in-person in their dance studio (Group 3: $N = 5$, $M_{age} = 13+2$, $dance_{yrs}$ $M = 7.8+2$). Performances were blind reviewed, by 4 experienced dancers, for movement accuracy and timing/musicality errors on a scale 1 (largest # of errors) – 5 (no errors). The results of a Kruskal Wallis ANOVA test were not significant for accuracy (H=2.179, 2 d.f., $p = .336$) or timing (H = 1.107, d.f., $p = .575$). However, the results did indicate that there is a difference between levels regardless of the learning setting. Advanced dancers scored significantly better for accuracy errors (H=7.83, 1 d.f., $p = .005$) than intermediate dancers. These results demonstrate that advanced dancers are better equipped with the skills needed to learn dance in unfamiliar settings than intermediate dancers. Additional research should identify key cues needed for novice and intermediate learners in the virtual learning environment.

Time Onset and Amplitude of Force Drift During Unimanual and Bimanual Isometric Contractions in Parkinson's Disease

Madison Weinrich, Texas A&M University; Yiyu Wang, Texas A&M University; Deanna Kennedy, Texas A&M University

Research has indicated that individuals with Parkinson's Disease (PD) have deficiencies in the regulation of force over time. The purpose of this study was to determine the time onset and amplitude of force drift after removal of visual feedback and to determine whether unimanual or bimanual control influences force drift. PD patients ($N = 8$ Mean age = 71.8 years) and age matched healthy controls ($N = 8$, Mean age = 71.5 years) were instructed to accurately match the target force at 10% of their maximal isometric force (MVC) with abduction of the index finger(s) and maintain their force in the absence of visual feedback. Each trial lasted 20 s and visual feedback was removed after 10 s. Participants performed both unimanual and bimanual trials. In the unimanual trials participants performed the task with either their left or right index finger and visual feedback was removed from the active limb. In the bimanual trials participants performed the task with both

limbs and visual feedback was removed for either the left or right limb. Participants performed 6 trials for each condition. The time onset for force drift was quantified as the initial time when the force deviated more than 5% from the target force and for more than 2 s. The amplitude of force drift was quantified as the percent difference from the average force that was exerted 2 s prior to removal of visual feedback. Independent of the condition (unimanual, bimanual) the onset of force drift was approximately 1.8 s for PD and 2.4 s for older adults. This time is significantly longer than the previously reported time onset of 1.5 s. The time onset and amplitude of force drift was significantly lower for bimanual control than unimanual control for both groups. However, bimanual control significantly reduced the time onset and amplitude of force drift for PD when compared to their aged-matched controls. The results suggest that bimanual control may ameliorate force control deficits in individuals with PD.

"Don't Be a Tool!": No Evidence for Tool Embodiment From an Investigation of Proximity Effects in Hand and Rake Responses

Timothy Nevin Welsh, University of Toronto; April Karlinsky, California State University, San Bernardino; Jay Pratt, University of Toronto

Tools, such as baseball bats and hockey sticks, are objects that are specially made to serve a specific function. Practice and active tool-use is hypothesized to lead to "tool embodiment" wherein the tool is coded as an extension of the effector that wields the tool. The present experiment was designed to test the tool embodiment hypothesis by assessing the influence of the relative proximity of hands and tools on the detection of visual targets. Participants ($n = 40$) completed choice reaction time (RT) tasks in which they pressed a left or right button in response to the appearance of targets on the left or right side of a computer screen. Response buttons were pressed either directly by the hands (Hand task) or by the ends of rakes held in the hands (Tool task). Prior to the Tool task, participants completed a tool-use practice session in which they used the rakes to move a ball around a "Figure-8" course. Each task was completed in two separate conditions: 1) Proximal condition in which the buttons pressed by the hands or the end of the tool were on the screen near the targets; and, 2) Distal condition in which the buttons pressed by the hands or the end of the tool were on the tabletop far the targets. In the Hand task, RTs were longer in the Proximal condition than in the Distal condition, $F(1,39) = 4.29$, $p < .05$. This proximity effect is thought to emerge because information presented near the hands is more likely to be acted upon and, hence, differentially processed compared to information farther from the hands that is less likely to be acted upon. If tool embodiment occurred and the rake was coded as an extension of the hand holding it, then a similar proximity effect should emerge in the Tool task. The results did not support this prediction; no differences in RTs with rake responses where found in the Proximal and Distal conditions, $F(1,39) = .01$, $p < 0.92$. Thus, the results of the present study do not provide evidence in support of the tool embodiment hypothesis. Funding source: Natural Sciences and Engineering Research Council of Canada.

The Effects of Maximal Voluntary Contraction Imagery Practice on Skeletal Muscle Contractile Properties

Björn Wieland, Goethe University; Michael Behringer, Goethe University; Karen Zentgraf, Goethe University

Studies concerning motor imagery (MI) practice based on maximal voluntary contraction (MVC) with different designs and training protocols have found changes in maximal strength. However, the mechanisms of adaptations via MI practice are not yet fully understood. To date, there is a lack of information on the effects of MI training on contractile properties of the imagery-trained muscle. Therefore, 45 trained subjects in three intervention groups practiced three times per week over a period of four weeks. Group MI conducted MI practice of maximal isometric contraction of the M. biceps brachii. The physical practice (PP) group executed maximal isometric contractions in a biceps curling machine. Group VI performed visual imagery training of a landscape. Duration of all intervention sessions was identical. At baseline and after the interventions, MVC and muscular properties of the arm flexors were measured. The muscular properties of M. biceps brachii were tested via tensiomyography measurements manipulating proprioceptive information (with or without muscle effort). Results of the 2×3 (time; group) ANOVA show an interaction effect for MVC, $F(2, 39) = 3.4$, $p = .027$, $\eta 2 = 0.17$, post-hoc analysis reveal no specific differences. However, analyzing %-change of MVC (PP: 5.9%; MI: 2.1%, VI: -1.3%), Bonferroni-adjusted post-hoc analysis reveal significantly ($p = .006$) higher improvements in the PP than VI group. The 2x2x3 (time; effort; group) ANOVA for maximal radial displacement of M. biceps brachii show no interaction, time or group effects, but a main effect of effort $F(1, 39) = 1120.1$, $p < .001$, $\eta 2 = 0.97$. Post-hoc analysis highlight greater values for 'no muscle effort' ($p < .001$). A reversed trend of %-change compared to MVC was observed by maximal displacement (PP: -2.6%; MI: -5.7%; VI: 3.8%), indicating a stiffer muscle after PE and MI interventions. Our results suggest that strength gains are associated with an increase in muscle stiffness due to a greater cortical output to the spinal motoneuronal pool (i.e., neuromuscular excitation) via PE as well as MI.

The Influence of Auditory Cuing on Stroke Rate in a Swimming Post-Test

Rachel E. Williams, The University of Tennessee, Knoxville; Jedediah E. Blanton, The University of Tennessee, Knoxville; Tjaša Pintar, The University of Tennessee, Knoxville; Jared M. Porter, The University of Tennessee, Knoxville

Equipment similar to a metronome provides auditory cuing to guide a person's movement pace. It is unknown if learning transfers to a performance setting where auditory cuing is unavailable. Though the use of tempo training is popular in swimming practice, it is prohibited in competition. The purposes of the current study were to (P1) determine if using a tempo trainer influences swimmers' ability to maintain stroke rate in a transfer test, and (P2) to determine if swimmers' self-efficacy in maintaining stroke rate changes based on the presence of a tempo trainer. A total of 15 female swimmers ($x_{age} = 19.80$, $SD = .147$) volunteered to participate from a Division I National Collegiate Athletic Association team. The study consisted of three rounds of a swim workout (pre-test, intervention, post-test). Participants were randomly assigned to a control or experimental group. Both groups were instructed to maintain the same stroke rate for the entire workout. The experimental group, however, was provided with a tempo trainer to use during the intervention round, and then asked to remove the tempo trainer for the post-test. Participants' average stroke rate was recorded, and they responded to questions before and after each trial (four trials per round) to measure self-efficacy and subjective success for maintaining stroke rate. A time main effect indicated from pre-test to post-test, all participants decreased stroke rate ($F(1, 13) = 17.18$, $p < .001$), and increased subjective success ($F(1, 13) = 6.43$, $p < .05$). There were no stroke rate differences observed between the control and experimental groups; this raises the question about the effectiveness of utilizing auditory cues (i.e., metronomes) during swim practice for the purpose of improving stroke rate during competition. Future research should consider increasing the time between the intervention and the post-test to further examine the effects of tempo training on swimming stroke rate.

Exploring the Attentional Focus of Elite Jump Rope Athletes: Toward the Development of an Expert-Modeled Attentional Cue Structure

Kaylee F. Woodard, Western Kentucky University; Logan T. Markwell, University of Tennessee, Knoxville; Jeffrey T. Fairbrother, Auburn University

A large body of research has demonstrated the advantages of external focus instructions for enhancing motor performance and learning. A subset of this research, however, has shown that experts tend to perform similarly under internal and external focus cues, often excelling under control conditions (e.g., Couvillion & Fairbrother, 2018; Wulf, 2008). Such findings suggest that these performers have likely developed personally advantageous focus strategies to support effective learning and expert performance. It seems reasonable, given the undeniable success of expert performers, that insight into their attentional tactics during the learning process could be useful for developing more refined instructional strategies for other populations. The current study required expert jump rope athletes to learn new, high-level jump rope skills over a two-week period and report on the attentional targets they employed during practice. Seven expert athletes reported their attentional foci during the preparation and execution stages of each practice trial across the two weeks of practice. Pre- and post-training surveys and interviews were conducted to gain further insight into the athletes' strategies and experiences. Upon completion of the practice phase, data were transcribed, coded, and analyzed by two separate raters. Results showed that experts focused on a wide range of cues related to control of the upper limbs and the rope as well as the movements of the lower body. Most cues were internal or non-distinguishable (i.e., neither clearly internal nor clearly external) and were frequently used in the context of explicitly stated and externally focused goals. Patterns revealed new insight into experts' attention and learning strategies such as the tendency to spontaneously shift from an internal focus during preparation to an external or neutral focus during the execution of practice trials.

Motor Performance and Learning Under Memory Interference: Proactive and Retroactive Effects

Elyse S. Wu, Tamkang University; Hank J. Jwo, National Taiwan Normal University; Chia-Sheng Huang, National Taiwan Normal University

Motor skill learning often occurs in rapid succession, leading to competition in consolidating memories. Especially when a new motor skill is in the course of acquisition, memory expression is attenuated. Moreover, this constant aggregation of new motor skill can interfere with past and future learning experience. Proactive interference (PI) exists when past motor skill learning interferes with new skill learning, while retroactive interference (RI) is the attenuation of memory for previous skill learning as a result of new one. Thus far, despite the numerous literatures on both PI and RI, factors that determine which of these two different types of interference affect motor learning and how they affect it are less understood. This study aimed to examine the effects of practice under PI and RI conditions in learning two similar sequences of discrete movements on motor performance and learning. Thirty-six participants ($M_{age} = 20.0 \pm 2.4$ years) were randomly assigned into one of proactive interference in recency (PR), retroactive interference in primacy (RP), and summary knowledge of results (SKR) groups. Putting golf ball to a target with self-pace was used as experimental task. All participants practiced 54 trials during the acquisition phase, and a 24 hours retentions test were administered. The results showed that PR group and SKR group had significantly higher accuracy than that of RP group in acquisition phase. Furthermore, significant difference was found among three groups on accuracy in retention test, and SKR group was significantly higher AE than that of PR and RP groups. Findings from this study suggest that proactive interference can play an important role in skill acquisition, but it cannot make motor learning resistant to interference.

A Fitts' Reciprocal Tapping Task Differed by the Movement Direction: Statistical Parametric Mapping Analysis of the Acceleration Profiles

Masahiro Yamada, Moss Rehabilitation Research Institute; Nikita Kuznetsov, University of Cincinnati; Lauren Higgins, The University of North Carolina at Greensboro; Louisa Raisbeck, The University of North Carolina at Greensboro

It is well documented that external focus (EF) results in better motor performance than internal focus (IF) (Wulf, 2013). Although investigators have examined performance outcome measures to elucidate the underlying mechanisms of the attentional focus effect, one limitation is that the entire time-series of kinematic data are typically reduced into a scalar for analysis (e.g., peak velocity, maximum acceleration). This 'snapshot' approach fails to capture other parts of the data that may provide additional insights into the motor control process. Therefore, the present study adopted statistical parametric mapping (SPM) that affords the analysis of kinematic *patterns*. Twenty-one right-handed participants moved a cube reciprocally between the right (R) and left (L) targets as accurately as possible at two movement tempos (750 ms and 500 ms per stroke) with EF and IF cues. Each trial consisted of 30 hits, and participants performed two trials per condition. The hit-to-hit acceleration (the mediolateral direction) of the cube kinematics was captured with a 3D motion system. The acceleration kinematics of each trial were segmented into RL and LR strokes and time-normalized to 0 – 100%. Our results revealed no difference in attentional focus, but a significant difference in the direction of movement. During the 750 ms conditions, the RL acceleration was higher between 10.9- 14.7% ($p = .04$), lower between 24.3-34.2% ($p = .0102$) (i.e., better deceleration), higher between 55.9-69.6% ($p = .0021$), and lower between 86.7-96.9% ($p = .0094$) than the LR direction. Performance accuracy was lower on the R target than the L target. A higher acceleration at the beginning and a greater deceleration in the following section may indicate better motor control in RL than LR, potentially due to a neutral body position for right-handed individuals when moving RL. Our results did not show the attentional focus effects. However, future studies should consider the movement direction when analyzing motor control of a reciprocal Fitts' task.

The Differential Effect of a Distal External, Proximal External, and Internal Focus of Attention in a Bimanual Coordination Task

Masahiro Yamada, Moss Rehabilitation Research Institute; Omid Ansari Ansari, Shahid Bahonar University of Kerman; Ali Emami, Ferdowsi University of Mashhad; Alireza Saberi Kakhki, Ferdowsi University of Mashhad; Amanda Barclift, The University of North Carolina at Greensboro; Takehiro Iwatsuki, The Pennsylvania State University, Altoona

Attention directed to bodily movements (internal focus, IF) is detrimental compared to an environmental cue (external focus, EF) (Wulf, 2013). This EF effect is further pronounced when an EF is directed to a physically farther distance (distal EF, d-EF) than a cue close to the body (proximal EF, p-EF). Additionally, some literature proposed that p-EF is effective for novices and d-EF is more effective in skilled individuals. Currently, this hypothesis has been examined by comparing heterogeneous groups (i.e., high- versus low-skilled individuals); however, these groups may be fundamentally different in other characteristics beyond motor performance. Thus, in the present study, individuals with similar characteristics (i.e., novices) practiced a bimanual visuomotor task, and the attentional focus effect was examined at different learning stages. Participants were divided into one of the IF, d-EF, and p-EF groups ($n = 17$ each group) and practiced the task for four blocks of four trials, followed by 48-hour delayed dual-task tests in response to visual (visual dual-task) and auditory (auditory dual-task) cues. Performance between groups was analyzed a) between Block 1 and Block 4 during practice and b) under the dual-task transfer tests. Time-to-complete the task in second (Movement time, MT) and error duration (the duration of the cursor out of the course) were analyzed. For the practice effect, results of MT showed that p-EF was superior to IF during practice ($p = .027$). For the dual-task effect, in the auditory dual-task, d-EF was superior to p-EF ($p = .005$), and p-EF was

superior to IF ($p = .03$) in MT. For error, while both EF groups reduced errors across the experiment, the IF group did not improve errors. Our results suggest that a p-EF may be more beneficial in the early stage of motor learning. After practice, a d-EF promoted greater automaticity than a p-EF or IF, which may have led to better dual-task performance. The present study suggests the differential benefits of p-EF and d-EF based on the learning stage of the learners. Funding: N/A Funding source: NA.

Is Autonomy Support Beneficial in Golf Putting Under Psychological Pressure?

Shota Yoshihara, Kitasato University; Masahiro Yamada, Moss Rehabilitation Research Institute; Aya Mitani, University of Toronto; Takehiro Iwatsuki, Pennsylvania State University, Altoona College

The OPTIMAL theory proposes that giving choices to learners (i.e., autonomy) enhances motor performance by increasing the focus on the task goal and self-efficacy (Wulf & Lewthwaite, 2016). An alternative hypothesis suggests that autonomy increases information-processing of the task; this reduces uncertainty about the task, leading to better performance with little influence on perceptual constructs, such as motivation and self-focus (Carter et al., 2014). To further develop the understanding of the autonomy effect, the present study replicated the study by Iwatsuki and Otten (2021) that demonstrated the beneficial autonomy effect on golf putting performance under psychological pressure. To examine the autonomy effect on the perceptual constructs, we additionally obtained questionnaires about self-focus, self-efficacy, and perceived choice. Participants in the control ($n = 14$) or autonomy ($n = 14$) group completed familiarization trials (30 putts) of a standard golf putting task. Following the familiarization trials, the autonomy group received a choice about the color of the balls, while the control group did not receive such a choice. Both groups performed the same task under psychological pressure and then completed additional trials 1 meter farther away than the practiced distance under psychological pressure. Questionnaires and performance (accuracy as Mean Radial Error, MRE, and variability as Bivariate Variable Error, BVE) were used as dependent variables. The results of BVE showed a reaching significance between groups ($p = 0.076$), suggesting that the autonomy group was trending to perform better in BVE than the control group. However, we did not observe any significance in self-focus, self-efficacy, or perceived choices ($p > 0.05$). Our results favored the increased information processing hypothesis. Alternatively, autonomy may have essentially little to no effect on motor performance, supporting the most recent meta-analysis (McKay et al., accepted). Funding: N/A

Effects of Multi-Obstacle Contexts on Obstacle Negotiation Strategies in Healthy Older Adults Under Dual-Task Conditions

Jung-eun Yun, Korea University; Jin-hoon Park, Korea University

Background: Deterioration of cognitive domains is one of the main causes of decline in obstacle crossing performance in the elderly. Although age-associated changes in avoidance strategies when negotiating obstacles have been extensively studied, little is known about adaptive mechanisms in the elderly regarding multiple obstacle crossings with different execution demands. *Research question*: To better understand obstacle avoidance behaviors in the elderly, this study investigated adaptive mechanisms related to planning and implementing more complex multi-obstacle contexts. Would older adults adopt a more cautious avoidance strategy such as prolonged duration or elevated foot height prior to clearing an obstacle with increased task demands of obstacle negotiation? *Methods*: Eleven healthy older and 11 young adults participated in the experiment. We examined how the presence and physical property of the second obstacle influenced the planning and adjustments for obstacle avoidance performance. Spatiotemporal characteristics of the stepping movement were analyzed using a 3D motion capture system. *Results*: Older adults showed a longer stance time before crossing the first obstacle than young adults when the task complexity increased. These stepping characteristics were more evident in the dual-task condition. However, their foot clearance and crossing speed were not influenced by the level of task complexity. *Significance*: These results suggest that changes in task demands of obstacle negotiation appeared to influence the planning of stepping strategies rather than the implementation of motor programs for obstacle crossing in healthy older adults. Such altered obstacle negotiation behaviors in older adults may be due to general cognitive decline with advancing age or a compensatory adjustment strategy for enhancing postural stability when performing challenging or complex obstacle tasks.

The Sensitivity of Vertical Dancers in Detecting Artificially Inverted Dance Movements in Point-Light Displays

Qin Zhu, University of Wyoming; Yu Song, University of Wyoming; Boyi Dai, University of Wyoming; Margaret Wilson, University of Wyoming; Minkai Dong, Shanghai University of Finance and Economy; Gulandanmu Ma, Shanghai University of Sport; Yuehan Yang, Shanghai University of Sport; Xiaoye Michael Wang, University of Toronto

The inversion effect is well-known in biological motion perception, in which flipping the biological motion display upside down impairs the ability to recognize the motion. Vertical dancers (VDs) often observe and perform dance movements upside-down when their bodies were suspended in the air through a harness. Would this experience enable them to perceive the inverted dance movements better than others? Two VDs were invited to a motion capture lab to perform 10 pairs of dance movements both on the ground and in the air with a harness suspended from the ceiling. They were selected to be congruent either in form or direction of movement. Reflective markers were attached to the dancer's head and major joints to produce point-light displays (PLDs). All PLDs were edited to show each movement three times, although one of dancers' movements were trimmed short to display only the last second of move before repetition. Then, all PLDs were artificially inverted and randomly mixed with the original movements to create two testing sequences: one with complete motion, another with partial motion. Participants were asked to judge whether the movement was displayed as-is or was artificially inverted. 52 adults participated in this experiment, among which 15 were non-dancers, 21 traditional dancers, and 16 vertical dancers. The sensitivity (d') to the artificial inversion was calculated for each participant before a mixed-design ANOVA was used to evaluate interested factors. Results showed that participants, regardless of dance experience, could not distinguish movement's inversion when judging partial motions ($p = 0.44$). However, when judging the complete motions, VDs were more sensitive than others only in detecting the artificially inverted movements performed in the air when the air and ground movements were incongruent in direction ($F_{2, 49} = 10.66$, $p < .001$). These results supported the hypothesis of kinematic specification of dynamics for biological motion perception.

The Use of a Holistic Focus of Attention to Improve Long Jump Performance Among NCAA Track and Field Athletes

Tatiana A. Zhuravleva, New Mexico State University; Christopher A. Aiken, New Mexico State University; Pin-Chen Lin, New Mexico State University; Jack J. Sampson, New Mexico State University; Sean M. Cochran, New Mexico State University

Attentional focus research involving experienced performers has shown mixed results. Research has shown that experienced performers have

performed better under an internal focus, an external focus, and a control condition. Recent studies show that holistic focus of attention can be utilized for tasks when an external focus is not practical (Becker et al., 2019). One potential explanation for the benefit of a holistic focus may be that the focus is more familiar to the performer than the attentional change to an internal or external focus. The purpose of our study was to examine various attentional foci, including a holistic focus of attention, within NCAA division I track and field athletes. 16 female athletes performed a standing long jump under three focus conditions in a regulation long jump field with an orange cone placed 5m from the jump line. All participants performed warm-up exercises followed by a familiarization trial. Participants then performed three jumps in three attentional focus conditions, internal (IF), external (EF), and holistic (HF), in a counterbalanced order. Following the three jumps for each condition, participants reported their adherence to the focus cue and noted their cue preference at the conclusion of the study. Separate repeated measures ANOVAs with Sidak post-hoc were used to analyze both jump distance and adherence. A significant main effect for jump distance was observed (p=.016) where HF jumped significantly further than IF ($p < .01$). No other differences between conditions were observed. There were no significant differences between conditions observed for adherence to the prescribed focus of attention ($p > .05$). Nine of sixteen athletes preferred the use of a holistic focus over that of internal or external focus. The results of this study support previous work showing that adopting a holistic focus leads to improved performance over an internal focus. Cue familiarity and preference may play an important role in the type of attentional focus in which skilled performers benefit.

A Holistic Focus of Attention Improves Performance and Focus Adherence During a Shot-Put Toss in Collegiate Track and Field Athletes

Tatiana A. Zhuravleva, New Mexico State University; Christopher A. Aiken, New Mexico State University; Pin-Chen Lin, New Mexico State University; Jack J. Sampson, New Mexico State University

Research involving attentional focus in well-trained individuals has shown a benefit for a variety of attentional foci, not just an external focus of attention. One attentional focus manipulation that has been largely unexplored within skilled athletes is that of a holistic focus, or focus on the general feeling of a movement. The purpose of this study was to examine various attentional foci within NCAA track and field athletes. Eighteen female athletes performed an underhand shot-put toss for maximum distance. Following a warm-up period and a familiarization trial, three throws under each of three focus conditions, internal (INT), external (EXT), and holistic (HOL) were performed in a counterbalanced order. The study took place at a regulation shot-put field, with an orange cone located 16m from the toe board. Throw distance was recorded after each throw. Following each condition, the adherence to the prescribed cue was recorded. The attentional focus preference was also recorded following completion of all throws. ANOVAs with repeated measures were used to analyze throw distance and adherence. A significant main effect was observed for throw distance ($p < .01$), with Sidak post-hoc revealing that HOL threw significantly further than INT ($p < .001$). A significant main effect was also observed for adherence ($p < .05$). Post-hoc tests indicated that participants were more adherent to HOL than INT ($p < .05$). 12 individuals indicated they preferred the use of the holistic focus, while four preferred an external focus, and two preferred an internal focus. These findings match previous research investigating novice performers which found a benefit to a holistic focus over an internal focus. Surprisingly we did not observe a benefit for an external focus over and internal, however, this coincides with some previous work with experienced performers. It is possible that the preference or familiarity with a holistic focus of attention plays a role in the improved performance and warrants further investigation.

Sport and Exercise Psychology Abstracts

Bye Bye Birdie: Exploring Why Young Canadian Women Athletes Drop Out of Competitive Badminton

Margo E. K. Adam, University of Toronto; Alyona Koulanova, University of Toronto; Ross M. Murray, University of Toronto; Catherine M. Sabiston, University of Toronto

Similar to many sports within Canada, participation rates for young women in competitive badminton declines sharply in adolescence. However, it is unknown how the badminton context specifically may be affecting young Canadian women athletes' decision to leave this sport during adolescence. Therefore, the purpose of this collective case study (Stake 1996) study was to explore and describe women athletes' dropout experiences and reasons. Eleven young women athletes between 14 and 25 years of age who dropped out of competitive badminton between 13 and 18 years of age participated in this study. Participants had a range of competition experience, from local to international levels. The transcribed interview data were analysed through an iterative reflective thematic analysis process (Braun & Clarke, 2022). From the data, six themes were generated to best reflect the collective experiences and reasons the women athletes discussed for dropping out of competitive badminton during adolescence. The themes include: i) primary sport conflicts, ii) toxic and difficult training and competition contexts, iii) skill and performance dissatisfaction, iv) pressure and recognition, v) health and fitness, and vi) so much time alone. Although sport dropout is common for adolescent women, the findings of this study highlight that sport and context specific factors can contribute to women's decision to drop out of competitive badminton. As such, promoting continued participation for women in badminton will require sport and context specific solutions and strategies. Funding source: This project was supported by SIRC Match grant funding working collaboratively with Badminton Canada.

Do We Know the Score? DEI Data in the Olympic and Paralympic Movement

Kat V Adams, Utah State University; Travis E Dorsch, Utah State University

In accordance with the Ted Stevens Olympic and Amateur Sports Act (1998), the United States Olympic and Paralympic Committee (USOPC) collects annual data from the 61 National Governing Bodies (NGBs) under its purview. In the form of DEI Scorecards, these data have become a marker of organizations' progress toward stated participation goals. The purpose of the present study was to identify areas of promise and shortcomings in gender and racial diversity within the United States Olympic and Paralympic Movement. Data were taken from the USOPC's DEI Scorecards for the years 2013 through 2020 ($N = 402$; range = 44-61 annually). Eleven of 61 organizations did not report their NGB membership in 2020, compared to 14 of 45 in 2013. Organizations with ties to professional leagues (baseball, soccer, basketball, golf) have never reported NGB membership. Others ($n = 5$) collect race/ethnicity data for a limited subset of members but not the entire organization. Of the NGBs that do produce complete DEI Scorecards, the diversity landscape is mixed. Women, despite comprising 47.5% of national team athletes, make up just 26.5% of national team coaches & support staff ($B = -0.21$), $t(746) = -16.77$, $p < .001$). A similar discrepancy exists for people of color, who make up 25.1% of national team athletes but just 18.4% of coaches & support staff ($B = -0.6$), $t(746) = -4.07$, $p < .001$). This difference is less pronounced at the developmental national team level, which may indicate change to come. Notably, these DEI Scorecard data lack an intersectional perspective – women of color are some of the biggest names in international sport, but

the degree to which they are involved within and across the movement remains unknown. To garner a more complete picture of who participates and who doesn't, data collection and reporting must include intersectional demographic breakdowns, and should be made more consistent across reporting organizations. While the existence of DEI Scorecards is a necessary step, their existence is not sufficient to ensure a diverse, equitable, and inclusive sport community.

"I Want to See Their Facial Reactions": Exploring the Perceptions and Experiences of Parasport Coaches Who Engaged in a Virtual Mentorship Program

Danielle Alexander, McGill University; Gordon Bloom, McGill University

Virtual learning (i.e., mentorship) programs have increased in popularity, both before and during the COVID-19 pandemic, in various contexts including academia, education, and sport. In sport, Grant and colleagues (2020) examined US lacrosse coaches who participated in an online mentoring program and found that coaches experienced both benefits and barriers of e-mentoring, including enhanced lacrosse-specific knowledge as well as technological challenges. Overall, there have been few formal mentoring programs for coaches of able-bodied athletes (both in person or virtual), and few if any for parasport coaches. Partnering with a provincial coaching association, this study explored the perceptions and experiences of 15 mentor and 29 mentee coaches who participated in a virtual parasport coach mentorship program. Data were gathered via focus groups and individual interviews and analyzed using a reflexive thematic analysis. Results revealed mixed preferences towards virtual learning. In some cases, mentee coaches appreciated the benefits of online learning, which involved greater accessibility across geographic locations, saving money on travel, and more frequent virtual events. However, coaches also noted the absence of an in-person connection and highlighted the limited type of learning available (e.g., theoretical versus practical knowledge). Mentors relied more heavily on scenario-based learning or sharing personal experiences to facilitate coach learning. These contrasting feelings indicate there is not one best approach to parasport coach learning, while highlighting the value in utilizing virtual spaces in conjunction with in-person events. We believe the continued implementation of this program will influence parasport progression and encourage researchers and community partners to work together to create the ideal parasport coach learning environment.

The Impact of Parental Pressure and Parental Beliefs About Early Specialization on Beliefs of Ability and Task Values

Katherine Alexander, Utah State University; Jordan A. Blazo, Louisiana Tech University; Andrew C. Parks, Louisiana Tech University; Daniel J.M. Fleming, Utah State University; Amand L. Hardiman, Utah State University; Dr. Travis E. Dorsch, Utah State University

Although parents play an important role in initiating and maintaining their children's sport involvement (Bremer, 2012), few studies have considered how parental beliefs supporting early sport-specialization and parental pressure may influence athlete outcomes. To address this gap, the present study retrospectively explored how parental beliefs about early sport-specialization and parental pressure related to athlete outcomes using Eccles' expectancy-value model. Participants included 228 college-aged students ($M_{age} = 20.5 \pm 1.63$ years; 79% female). 158 self-reported as early sport specializers. Valid and reliable measures of values, beliefs of ability, perceptions of parental pressure, and parental beliefs supporting sport-specialization were completed by participants. Ability beliefs ($r = -0.34$, $p < .01$), utility value ($r = -0.28$, $p < 0.05$), and cost ($r = 0.31$, $p < .01$) significantly correlated with perceived parental beliefs about specialization in non-specializers, whereas no significant correlations across expectancy-value outcomes and parental beliefs were found in sport specializers. Regression analyses were conducted to consider how parental pressure predicted expectancy-value outcomes, with parental pressure predicting cost ($b = 0.34$, $t(68) = 2.16$, $p < .05$) in non-specializers, and perceived pressure predicting attainment value ($b = 0.26$, $t(156) = 2.81$, $p < 0.01$), utility value ($b = 0.28$, $t(156) = 2.16$, $p < .05$), ability beliefs ($b = 0.22$, $t(156) = 2.43$, $p < .05$), and cost ($b = 0.33$, $t(156) = 3.88$, $p < .01$) in specializers. These results highlight the differences in perceived parental experiences and expectancy-value outcomes in specializers and non-specializers, while expanding current literature by including perceptions of cost. Furthermore, findings support the contributions of cost to athletes' motivational profiles and provide a more comprehensive examination of athletes' beliefs throughout a critical period when early relationships with physical activity and sport are established.

The Impact of Coaches' Emotional Abuse on Intercollegiate Athletes' Relationships and Team Dynamics

Katherine N. Alexander, Utah State University; Travis E. Dorsch, Utah State University; Kat V. Adams, Utah State University

Despite widespread anecdotal accounts of coaches' emotional abuse in sport, empirical literature in this area is lacking (Wilinsky & McCabe, 2020). Moreover, few studies have examined emotional abuse within the context of intercollegiate athletics. In an effort to address this gap, the present study was designed to explore how student-athletes interpret emotionally abusive coaching behaviors and how those behaviors influenced their interpersonal relationships and team dynamics. The study was also designed to explore the sources and patterns of support recalled by participants. Thirteen former female NCAA student-athletes and one former female NJCAA student-athlete ($M_{age} = 25.3$ years), representing a range of sports and institutions, took part in retrospective, semi-structured interviews. Data were interpreted using a constructivist grounded theory approach (Charmaz, 2014). Results suggest that across the 14 coach-athlete relationships, ideas of control, inconsistency of behaviors, and punitive practices marked student-athletes' experiences of emotional abuse. Participants appeared to go through an adaptation process, wherein the abusive behaviors and their consequences became normalized over the course of their careers. Across participants, various patterns of cohesion and division across the team dynamic occurred. Importantly, a range of individuals played a vital role in providing emotional support to the victims of the abuse. Although all participants reported the abusive behaviors to university administrators or support staff during their time on campus, no action was taken to protect them from further abuse. Studying the perceived impacts of abusive coaching practices on interpersonal relationships and team dynamics has the potential to provide a more holistic understanding of how negative coach behaviors may influence individuals, teams, universities, and the intercollegiate sport model. Insights into a lack of oversight and investigation by institutions also highlight a need for systems of legal protection for intercollegiate student-athletes.

Influence of Advertisements on Perceptions of Health and Attractiveness

Diana Avans, Vanguard University of Southern California; Cambria Fernandez, Vanguard University of Southern California; Vashti Elias Romero, Vanguard University of Southern California

The purpose of this study was to explore the influence of body inclusivity ads on perceptions of health and attractiveness. With an increasing push for

body inclusivity in marketing and advertising, health professionals are starting to question if the standards promoted are helpful or are they pushing the acceptance of physically unhealthy standards. We hypothesized the rating of body inclusive ads would be positive and there would be a relationship between body image and the perceived attractiveness and health of various sized models. A survey was created using four body image questions (scale 1-5) followed by participants rating images of male and females of varying shapes, weights, and sizes in underwear, athletic wear, and street clothes on a Likert scale of 1-10 for attractiveness and health. Free responses allowed participants to express their emotions while rating the images. The sample included college-age men and women ($N = 100$). The means for the body image questions were above 3.00 with the highest on "I think about the way I look often" ($M = 4.10$, $SD = 0.9$). There were significant differences by gender ($p < .01$) with women scoring higher on the 3 negative body image questions and men scoring higher on the one positive question. Athletes scored lower than non-athletes regarding "I think about the way I look often" ($p < .01$). The images rated highest for health and attractiveness were of non-model women in street clothes, lean men in athletic and street wear, and a bikini model. A women's underwear ad used models of all sizes was rated high for health, but a similar ad using male models was rated the least healthy and attractive. Other lower rated ads were female plus-size underwear and street wear model images. Free responses provided insight that men had difficulty rating the attractiveness of other men and the ads made participants more aware of how they judge themselves and it encouraged them to be more forgiving. This research should be continued to better evaluate the effects of body inclusive advertisements on body image and self-perception.

Factors Affecting the Acceptance of Transgender Athletes in Sport

Diana Avans, Vanguard University of Southern California; Kelsey Bryant, Vanguard University of Southern California; Marielisa Hallam, Vanguard University of Southern California

Transgender athletes competing in all levels of competition is being debated and policies created, and enforced. This study examined factors influencing the acceptance of transgenders in sport. A secondary aim was to determine the relationship between the individual's religious identity, athlete identity and sense of justice and the acceptance of transgender athletes. The survey included measurement scales for Athletic and Religious Identity, and a Just World (AI, RI, JW) with scenario-based questions adapted from Tanimoto & Miwa (2021). Participants (N=100) included students identifying as male, female, athletes, non-athletes, multiple ethnicities, and years in school. The means scores for AI, RI and JW scales were calculated, and no significant gender or class differences were found. Regarding acceptance, respondents stated that transgender athletes should be accepted at leisure and recreational levels (89, 64%) with the acceptance dropping to 50% for scholastic competition, 33% for collegiate and 17% at pro/elite levels. Regarding current acceptance, the findings were similar until the collegiate level which dropped to 19%, 14% at the pro/elite level. The group most readily accepted to participate was transgender males in men's sport (67%), with neither are accepted at 19.4%, and transgender women in women's sport at 11%. Competition scenarios included transgender women and men competing on men's and women's teams. The responses were influenced by the type of hormone therapy undergone. Trans men competing on a men's team within testosterone regulations was the most accepted scenario. The most disagreed with scenario was a transgender woman competing on a women's team regardless of the hormone status. There were significant, moderate to strong negative correlations on each of the identity scales and acceptance. Further study seeks to increase and diversify the sample. Identifying the multiple perspectives that influence the participation of transgender athletes is necessary to create supportive, fair participation plans.

Psychological Analysis of Online Class Experience and Performance Perception Among College Students Majoring in Dance

Hyunsoon Baek, Korea National Sport University; Yanghee Kim, Korea National Sport University

COVID-19 pandemic forced classes in colleges to be online. Dance practice classes are for training of the physical expression and their goals are usually achieved through face-to-face training. Thus, the online dance practice classes are bound to be limited in their effectiveness. The purpose of this study is to find out the psychological effect of the online classes on students' class-experiences and performance- perceptions. This study used in-depth interview as in Lee (2005) and Giorgi's phenomenological method (1985) through four steps suggested by Kim et al (1999). Interviewees for the study were selected among students majoring in dance who have participated in online classes for at least two years and are expected to honestly express their experiences for the validity of the study. The data of the study were collected for 20 days in December 2021, after classes ended. The questionnaire for the interview was made in reference to advice by three professors of psychology. The collected data are analyzed using the method of Giorgi.The findings of the study are as follows. Firstly, study participants expected upon entering the college to develop skills through practices for performances and extracurricular activities as well as regular classes. But the pandemic blocked opportunities and online classes fell far short of such expectations. Secondly, participants think that they can enhance their performance not only through the guidance of the instructors but also through offline activities with their colleagues. However, since online classes do not provide platforms to compare their skills with others, it is difficult for them to grasp their strength and weakness. Thirdly, the participants felt that online classes did not have enough intensity as offline classes because of lack of audiences. They thought that training without audiences does not help improve performance skills. All these findings lead us to conclude practical performance education must be provided in face-to-face classes.

Psychosocial and Environmental Correlates of Adolescent Physical Activity During COVID-19

Yang Bai, University of Utah; Ryan Burns, University of Utah; Wonwoo Byun, University of Utah

The coronavirus pandemic (COVID-19) caused school closures and disruptions in youth sports and activity classes that limited engagement in physical activity (PA). The current study examined the psychosocial and environmental correlates of objective PA in young adolescents during COVID-19. Participants were 67 adolescents enrolled in a public US middle school (49.3% male, M_{age}=12.9 years). The outcome variable was objectively measured moderate-vigorous PA (MVPA) using the Actigraph GT3X during December 2021. Questionnaires were administered to the students the same week of PA assessment. One set of independent variables were a self-report of social support for PA, including peer support (2 items) and parent support (6 items). Other psychosocial measures were self-report items asking about barriers to participate in PA (5 items), motivation for PA (5 items), and self-efficacy for PA (1 item). Home and neighborhood environments were assessed using the self-report bedroom televisions availability (1 item), exercise equipment availability (8 items), and a self-report of neighborhood safety (2 items). All 5-point Likert responses were coded so that low scores indicated unfavorable responses. A general linear regression model was used to examine the association between psychosocial and environmental variables with objective MVPA controlling for age, sex, and parental education. Parental PA support ($\beta = 0.33$, CI: 0.04, 0.63, $p = 0.03$) was significantly related to objective MVPA, whereby higher parental PA support associated with higher MVPA. Having a televisions TV

in the bedroom is associated with lower MVPA (b =-0.29, CI: -0.56, -0.05, p=0.02). However, an inverse association was found between motivation and objective MVPA (b =-0.31, CI: -0.61, -0.02, $p = 0.036$). Higher parent support for PA and the absence of bedroom televisions were associated with higher MVPA among adolescents during COVID-19. This finding may help inform strategies to promote PA in adolescents to prevent increases in health risk because of COVID-19 restrictions. Funding source: Internal funding.

Body-Related Factors Associated With Young Adult Women's Motives for Exercise

Jade Alexandra Bailey, Western University; Madeline Wood, University of Toronto; Eva Pila, Western University

Researchers have proposed that the psychological benefits of exercise behaviour may be dependent on the underlying motives that drive exercise behaviour. For example, appearance-related motives for exercise are associated with negative psychological correlates (e.g., body dissatisfaction, disordered eating, negative self-conscious emotions), and health-related motives for exercise are associated with positive correlates (e.g., pride). Extant literature has focused on a limited range of psychological correlates, and there is a gap in understanding body-related risk and protective factors that influence functional versus appearance motives to exercise. The present study examined the relations between body-related protective (i.e., body appreciation) and risk factors (i.e., fear of fat) on motives for exercise in a sample of adult women. Cross-sectional online survey data was collected from a sample of women aged 18 to 30 years old (n = 899; $M_{age} = 24.66$, $SD_{age} = 3.38$). Aligned with hypotheses, structural equation modelling revelated significant associations between body appreciation and motives for exercise related to weight (b = -0.09, 95%CI[-0.01,-0.09]), health ($b = 0.30$, 95%CI[0.22,0.38]), strength ($b = 0.44$, 95%CI[0.33,0.54]), and flexibility ($b = 0.34$, 95%CI[0.24,0.45]). Further supporting hypotheses, fear of fat was associated with appearance ($b = 0.13$, 95%CI[0.10,0.16]) and weight motives ($b = 0.24$, 95%CI[0.20,0.28]) for exercise. Taken together, these findings extend current literature on the differential psychological effects of appearance versus functional motives for exercise. Specifically, women who appreciate their bodies engaged in exercise for functional reasons, and women who endorse anti-fat attitudes engaged in exercise for appearance-management reasons. While the current study design precludes causal conclusions, future research attention should be paid to the effects of cultivating body appreciation and reducing anti-fat attitudes in the promotion of exercise behaviour.

Team Cohesion as a Predictor of Self-Determined Motivation and Well-Being: A Multilevel Approach

Isabel Balaguer, University of Valencia; Natalia Martinez-Gonzalez, University of Valencia; Francisco Atienza, University of Valencia; Joan L Duda, University of Birmingham

Previous research has found athletes playing on highly cohesive teams to exhibit greater satisfaction, personal and social development, and emotion regulation. With the aim to further understand the social psychological processes explicating the link between team cohesion and optimal functioning in athletes, this study examined the relationships between team-level team cohesion (task and social) with subjective vitality through self-determined motivation (the last two variables examined at the individual level). Participants were 268 basketball players (68.3% males, 31.7% females) aged between 10 and 43 ($M_{age} = 17.36 \pm 5.49$). A total of 40 teams with an average of 20.57 ($SE = 11.68$) players per team completed a set of online questionnaires assessing the variables of interest. Multilevel analyses revealed that task cohesion at the team level positively and significantly related to athletes' degree of self-determined motivation ($a = 1.07$; $p < .05$), with in turn was positively related to subjective vitality ($b = .13$; $p < .01$) at the individual level. The direct relationship between task cohesion and subjective vitality was not significant ($c' = .21$; $p > .05$). The indirect effect estimate was 0.15 ($SE = 0.082$) and the distribution of the product of coefficients method 95% CI was [0.019, 0.34]. Team-level social cohesion positively predicted athletes' self-determined motivation ($a = 0.95$; $p < .05$) with in turn was positively related to subjective vitality ($b = .13$; $p < .01$). The direct relationship was also not significant ($c' = .10$; $p > .05$). The indirect effect estimate was 0.133 ($SE = 0.077$) and the distribution of the product of coefficients method 95% CI was [0.011, 0.309]. Findings suggest that both task and social facets of team cohesion (task or social) are positively and indirectly related to subjective vitality through self-determined motivation. Therefore, developing strategies in sport to promote team cohesion is fundamental in order to contribute not only to team optimal functioning, but also to the individual well being of athletes.

Evidence-Informed Recommendations for Developing Physical Activity Messages Targeting Parents of Children With Disabilities

Rebecca L. Bassett-Gunter, York University; Jennifer R. Tomasone, Queen's University; Amy E. Latimer-Cheung, Queen's University; Kelly P. Arbour-Nicitopoulos, University of Toronto; Kathleen A. Martin Ginis, University of British Columbia Okanagan; Katerina Disimino, York University; Victoria Larocca, York University; Lauren Tristani, York University

Persuasive and informative messages are a valuable tool for promoting parent support for physical activity (PA). Parents of children with disabilities have expressed unique PA messaging needs. However, PA organizations require guidance in developing appropriate messages that meet the needs of parents of children with disabilities. Guided by the AGREE II Instrument, the purpose of this project was to establish evidence-informed recommendations for developing PA messages targeting parents of children with disabilities. Coproduction between the researchers and stakeholders from community-based organizations was a core principle of the project in order to support practical implementation of the recommendations beyond the research realm. A systematic scoping review of the literature informed draft recommendations ($n = 23$) which were then discussed and revised to penultimate recommendations ($n = 7$) via a two-day consensus meeting with researchers and stakeholders from community-based organizations. Broader consultation took place through an online survey completed by 53 stakeholders who rated the recommendations favourably (e.g., applicability 4.54/5) and provided feedback for refinement. Final recommendations ($N = 5$) were established across the following categories: 1) language and definitions, 2) program information, 3) benefits of PA, 4) PA ideas and self-regulation tools, and 5) barriers to PA. Community-based organizations should consider these recommendations when developing PA messages for parents of children with disabilities. This research provides a model for a scientifically rigorous process when developing evidence-informed recommendations to guide PA promotion practices. Future research will focus on the development of knowledge products to disseminate the recommendations to community-based organizations and support recommendation implementation through effective messaging strategies. Funding source: Social Sciences and Humanities Research Council of Canada; Ontario Ministry of Research and Innovation.

Measurement of Physical Activity Self-Efficacy: A Latent Variable Approach to Explore Dimensionality, Temporal Invariance, and External Validity

Andre Bateman, Michigan State University; Nicholas D. Myers, Michigan State University; Adam McMahon, University of Miami; Isaac

Prilleltensky, University of Miami; Seungmin Lee, Binghamton University; Ora Prilleltensky, University of Miami; Karin A. Pfeiffer, Michigan State University; Ahnalee M. Brincks, Michigan State University

The objective of this study was to improve the measurement of physical activity self-efficacy in adults with obesity. A latent variable approach was used to explore dimensionality, temporal invariance, and external validity of responses to a newly developed battery of Physical Activity Self-Efficacy (PASE) Scales. The PASE Scales were based on commonly measured domains (i.e., work-, transport-, domestic-, and leisure-related) and intensities (i.e., vigorous and/or moderate) of physical activity. Data ($N_{baseline} = 461$ and $N_{30\ days\ post\text{-}baseline} = 427$) from the Well-Being and Physical Activity Study (*ClinicalTrials.gov, identifier: NCT03194854*), which deployed the Fun For Wellness (FFW) intervention, were analyzed. Exploratory structural equation models were fit to the data. Oblique geomin rotation was used with Weighted least squares mean- and variance-adjusted estimation for categorical variable methodology. A two-dimensional factor structure explained responses to each PASE Scale at baseline. Factor 1 was conceptualized as *an up to 60 minutes* factor for moderate intensity PASE scales and as an *up to 30 minutes* factor for vigorous intensity PASE Scales. Factor 2 was conceptualized as a *60 minutes or more* factor for moderate intensity PASE scales and a *30 minutes or more* factor for vigorous intensity PASE Scales. There was strong evidence for at least partial temporal measurement invariance for this two-dimensional structure in each PASE Scale. There was mixed evidence for the effectiveness (i.e., external validity) of the FFW intervention to exert a direct effect on latent physical activity self-efficacy in adults with obesity at 30 days post-baseline of this two-dimensional structure. The evidence for external validity appeared to be dependent on intensity-level (i.e., vigorous versus moderate) and duration (e.g., up to 60 minutes or 60 minutes or more). The latent variable based results reported in this study extend results previously reported based on a traditional observed score approach.

Strengthening Coaching Trainings to Support the Whole Athlete: Findings From a State-Wide Survey of Youth Sport Coaches

Samantha Bates, The Ohio State University; Dawn Anderson-Butcher, The Ohio State University; Anthony Amorose, Illinois State University

Given mass participation rates and universal appeal, youth sport has the potential to positively impact children's health and development. However, positive experiences in sport often are dependent on interactions with coaches. Research demonstrates how coaching behaviors can impact life skill development and transfer, as well as motivation for continued participation and lifelong physical activity. Less well understood is whether youth sport coaches feel prepared to support the social, emotional, and mental health of youth participating in sport. This study was conducted among a U.S. sample of 5,219 school-based coaches in one large, Midwestern state. A majority of participants were male (88%), White (89%), had over 10 years of coaching experience (64%), and reported coaching over 30 different sports. Moreover, 25% of the sample were teacher-educators, meanwhile 75% were community-based coaches. Participants completed a self-report survey assessing confidence levels, prior training, and future training interests across four key areas: (a) coaching sport skills, techniques, and tactics; (b) creating a positive youth sport environment (i.e., promoting sportsmanship, teamwork); (c) utilizing sport psychology principles (i.e., mindfulness, mental imagery); and (d) responding to youth's social-emotional needs (i.e., addressing mental health concerns, identifying off the field stressors). Preliminary results indicated coaches feel increasingly confident (items ranging from 75% to 87% agree or strongly agree) *and* report prior training in regard to coaching sport skills, techniques, and tactics, as well as promoting a positive youth sport environment. In contrast, coaches were less confident (items ranging from 51% to 64% agree to strongly agree) *and* reported a high level of interest in trainings focused on mental health and sport psychology. This presentation will share findings from our state-wide survey, coupled with important implications for improving the youth sport environment, and training coaches to support children's holistic health and well-being. Funding source: Susan Crown Exchange.

Associations Between Burnout, Perceived Sport Stress, and Intrinsic Motivation Among Female-Identified Collegiate Club Sport Athletes: A Pilot Study

Ling Beisecker, The University of North Carolina – Chapel Hill; Madison C. Chandler, University of North Carolina – Chapel Hill; Nikki Barczak-Scarboro, Naval Health Research Center; Emily Kroshus, University of Washington; Johna Register-Mihalik, University of North Carolina – Chapel Hill; J.D. DeFreese, University of North Carolina – Chapel Hill

Prior research suggests athlete burnout, a maladaptive psychosocial experience (i.e., physical/emotional exhaustion, reduced accomplishment, sport devaluation), is positively associated with perceived sport stress and negatively associated with intrinsic motivation. Research thus far largely focuses on elite (i.e., collegiate varsity) athletes with limited study of the burnout experiences of non-elite level (i.e., collegiate club sport) athletes. Research specific to the numerous and extensive demands experienced by female-identified collegiate club sport athletes (FCCSAs) should further explore theoretically specified psychosocial predictors of burnout in this unique population. Accordingly, the purpose of the current study was to examine associations among perceived sport stress, intrinsic motivation, and athlete burnout in a sample of FCCSAs across a club sport season. We hypothesized athlete burnout would be associated positively with perceived sport stress and negatively with intrinsic motivation among FCCSAs. Participants completed valid and reliable psychometric assessments of study variables at pre-season, two-, four-, and six-weeks into the club season. A multilevel linear model conducted among disaggregated data of FCCSAs ($n = 30$, $M_{age} = 19.41 \pm 1.4$, 89.4% Caucasian) highlighted significant between-athlete variation in burnout over time (covariance intercept=.13, $p < .001$). Reported fixed effects include that, when perceived stress and intrinsic motivation were accounted for, burnout levels were highest between the pre-season and two-week timepoints (fixed effect =.17, $p = .002$). Perceived sport stress was significantly positively associated with athlete burnout across the club season (fixed effect = .27, $p < .001$) while intrinsic motivation was not (fixed effect = -.03, $p = .38$). Our pilot work suggests perceived stress is a salient in season predictor of burnout among FCCSAs. Researchers should continue to explore moderators of the stress-burnout relationship in this important population including additional contributors beyond stress and motivational factors.

Bootcamp or Booting Goals: Does Team Sport Hold Advantage Over Traditional Group Exercise on Men's Health?

Henry T Blake, University of South Australia; Alyson J Crozier, Wellbeing SA; Brad J Stenner, University of South Australia; Jonathon D Buckley, University of South Australia

Most middle-aged men are considered insufficiently active despite the positive influence of physical activity on overall wellbeing. As exercising in groups with social interaction can enhance adherence, leveraging the power of groups to engage middle-aged men to be active should be explored. Playing in a team sport is one potential group activity that is intrinsically motivating with positive physical health benefits; however, the psychological impact is less clear. As such, the current study aimed to examine the effect of team sport, compared to traditional group exercise, on middle-aged men's physical and psychological health. Motivation and

satisfaction of psychological needs were also assessed. Insufficiently active middle-aged men were randomised to a 12-week team sport (Australian Rules Football; $n = 37$) or outdoor group circuit ($n = 28$) program. Health (via the *SF36 V2)*, exercise motivation, and psychological needs satisfaction were assessed at baseline, post-program, and at 12-weeks follow-up. Significant improvements in five of eight *SF-36 V2* subscales and overall mental health status were identified for both groups at post-program ($p \leq .001$) and follow-up ($p \leq .029$). Both groups demonstrated significant improvements in motivation (integrated regulation and intrinsic motivation) and exercising competence across all time points compared to baseline ($p \leq .048$), with increased relatedness at post-program ($p < .001$) and autonomy at follow-up ($p = .032$). Between groups, only the *SF36 V2* subscale of bodily pain differed significantly, with larger scores for team-sport participants at post-program ($p = .032$). Results from this study show that participating in either mode of group exercise resulted in similar improvements in psychological health, self-determined motivation, and a sense of exercise competence and relatedness with exercise companions. Although, team-sport resulted in greater perceptions of bodily pain compared to circuit training at post-program. As such, team sport is a viable physical activity to promote for middle-aged men to improve health and wellbeing. Funding source: Australian Government Research Training Program Scholarship; Norwood Football Club Performance Sports Collaboration Scholarship.

Is It Worth the Risk? The Association of Parents' Health Concerns and Children's Well-Being During the COVID-19 Pandemic

Jordan Blazo, Louisiana Tech University; Travis Dorsch, Utah State University

A majority of American children engage annually in organized youth sport, and parents are intimately involved in their participation. With the onset of the novel coronavirus 2019 (COVID-19), many families have dramatically changed how they pursue and engage in youth sport. As the availability of vaccines has become more common, parents fear of illness has changed, resulting in different levels of sport engagement and well-being in the sport environment. The purpose of the present study was to better understand parental fears related to youth sport during the COVID-19 pandemic. To address this purpose, a large and statistically representative subset of youth sport parents from across the United States ($N = 1209$; $M_{age} = 39.2 \pm 8.7$ years) was recruited to complete a study-designed instrument as COVID-19-related restrictions eased. Adopting an ideographic approach, distinct parent profiles were created based on parents' own COVID-related health concerns and the COVID-related health concerns they had for their children. It was expected that parent profiles would differentially relate to youth sport engagement (i.e., time spent in sport) and parental beliefs regarding their child's well-being (i.e., mental and physical health, emotional control, and social well-being). A 3-cluster solution emerged from the data, representing (1) high parent and low child health concerns, (2) high child and low parent health concerns, and (3) high parent *and* child health concerns. Profiles exhibiting high parent and child health concerns were associated with significant increases to children's well-being during the pandemic. Profiles representing high child and low parent health concerns were associated with significantly lower well-being among children as pandemic-related sport restrictions eased. No significant differences were found regarding sport engagement. Collectively, the profile differences exhibited small to medium effects (i.e., $h_p^2 = .02 - .06$), suggesting that the profiles have practical significance for understanding how families have begun to re-engage with youth sport. Funding source: The Aspen Institute.

The Lone Defender: Understanding the Appraisal of Demands, Resources, and Subsequent Coping Behaviors of Goalkeepers

Carly Block, Florida State University; Svenja Wolf, Florida State University

Goalkeepers occupy an essential position and are the last line of defense for their team (Kristiansen et al. 2012). They encounter unique physical and psychological demands such as high pressure game situations (e.g., one-on-one; Villemain & Hauw, 2014), negative media content (Kristiansen et al., 2012), lower levels of team identification (Cameron et al., 2012), and critical training skills (Otte et al., 2020). In order to navigate these demands successfully, goalkeepers must be able to rely on suitable resources and effective coping behaviors. According to Lazarus' transactional theory of stress and coping (Lazarus, 1999), individuals respond to and cope with a demanding situation based on how they cognitively appraise it. Whereas there is limited literature on the general resources of goalkeepers (e.g., psychological skills; Rogerson & Hrycaiko, 2002), there is lack of understanding goalkeepers' own perspective of the stressors and coping behaviors within their position. Thus, the purpose of this study was to assess the appraisal of the demands, resources, and subsequent coping behaviors of goalkeepers. By using a transcendental-empirical phenomenological approach, 15 NCAA Division 1 goalkeepers from various sports completed two interviews. Data analysis consisted of coding first and second order constructs followed by a combination of structural and textural descriptions following Lazarus' model. Participants not only emphasized the positional, physical, and social demands but also uncovered intensity of mental demands (e.g., impact of making a mistake) they face due to the uniqueness of their position. Goalkeepers must rely on their ability of composure and present-focus thinking as a resource and coping behavior to perform well. Future implications suggest the importance of understanding a specific-sport position and providing applied practitioners and coaches with useful strategies and psychological interventions to ensure occupants of essential positions cope effectively and uphold their performance team (Crocker et al., 2015).

Mental Health Symptoms in Relation to Perceived Stress Among Canadian University Student-Athletes During the COVID-19 Pandemic Lockdown

Veronique Boudreault, Sherbrooke University; Sophie Labossière, Sherbrooke University; Véronique Gauthier, Université du Québec à Trois-Rivières; Sophie Brassard, Sherbrooke University; Frédérick Dionne, Université du Québec à Trois-Rivières; Sophie Couture, Sherbrooke University; Catherine Laurier, Sherbrooke University

The COVID-19 pandemic lockdown has led to the interruption of the university sporting season and resulted in negative consequences in both the academic and personal life of university student-athletes. This study aimed a) to document the prevalence of mental health disorders symptoms among them, and b) to identify the socio-demographic characteristics, pandemic impacts, and level of perceived stress that have had the greatest influence on the prevalence of mental health disorders symptoms. 424 university student-athletes ($M_{age} = 21.8 \pm 2.6$ years; 67,2% women) from 12 universities in Canada completed an online survey (Fall 2020) including measures of anxiety (GAD-7), depression (PHQ-9), and perceived stress (PSS-10). Descriptive analyses (frequencies, means, range, median, *SD*), binary logistic regression, and bivariate correlation analyses were performed with SPSS. Results indicate a high prevalence of symptoms of depression (37,9%) and anxiety (24,9%). Being a female, identifying oneself as a minority, having high perceived stress, and negative perceived impact on academic motivation statistically significantly explained 21.4% of the variance of depressive symptoms. Identifying oneself as a visible minority increased the risk of having depressive symptoms by 2.63 times, and being male decreased the risk of having depressive symptoms by 1.78 times. High-perceived stress increases the risk of experiencing depressive symptoms by 7.07 times and having experienced a negative impact of the pandemic on one's academic motivation increases the risk of experiencing depressive symptoms by 3.37 times. This study shows that the impact of

pandemic-related public health measures on university student-athletes athletic participation likely cut them off from an important protective factor regarding high perceived stress and depressive symptoms. This study supports the need for specific and available psychological and mental health prevention and intervention resources tailored for the unique needs of the population of university student-athletes.

Examining the Role of Behavior Economics: Developing a Physical Activity Program Through Charity Event Participation

Paige Bramblett, Appalachian State University; Kimberly Fasczewski, Appalachian State University; Sara Powell, California State University Monterey Bay

The theory of behavioral economics (BE) posits that decisions are not driven by a rational cost/benefit analysis, but rather based on emotions, personal bias, and environmental factors. Furthermore, individuals are more likely to participate in physical activity (PA) tied to an event that is fun, full of social interaction, and meaningful personal achievement. One particular type of event that can facilitate this connection is linked to a charitable cause. The National MS Society hosts both in-person and virtual PA-centered events in every region of the U.S. For this reason, and the positive emotional connection that individuals have to these events, this is an ideal environment to examine the connection between BE and PA. Therefore, using survey data collection, our lab explored the relationship between BE and PA motivation to participate in a PA-based multiple sclerosis (MS) fundraising charity event. Results indicated a personal connection to MS may increase an individual's motivation to participate in PA, and proposed a personal connection could be curated via education about MS. Using these data, we then designed a program for a virtual 5K training protocol with an educational component to foster a personal connection MS. Three different 5K training protocols were developed: walk, walk-run, and run to accommodate both beginner and more experienced participants. A Google Site was created as a platform to disseminate information and included an MS education program, additional run/walk training resources, and zoom link for weekly check-ins. The MS educational materials included links to videos about MS and comprehensive quizzes. The run/walk training resources included information nutrition, hydration, warm-ups, stretching, and injury prevention. Program enrollment was designed to occur on a rolling basis so participants can begin at their convenience and can include individuals with and without a connection to MS. Program implementation is currently ongoing, and being assessed for feasibility. Funding source: University Research Council (URC) at Appalachian State University.

Examining if a Personal Connection to Multiple Sclerosis Increases Motivation to Participate in a Fundraising Charity Event

Paige Bramblett, Appalachian State University; Kimberly Fasczewski, Appalachian State University; Sara Powell, California State University Monterey Bay

The positive health benefits of regular physical activity (PA) for those living with multiple sclerosis (MS) are widely known. However, PA levels are low among those with MS. To increase PA levels it is crucial to understand participant motivation. The theory of behavior economics (BE) posits that behaviors are not driven by a rational cost/benefit analysis but rather activities perceived as enjoyable are prioritized. Recent research exploring BE and PA motivation demonstrated that a personal connection, either personal MS diagnosis and/or family/friends of diagnosed, to MS may increase motivation to engage in a PA-based fundraising charity event. Therefore, the present research focused on creating a personal connection to MS via a 12-week training program to prepare participants to complete a 5K walk or run charity event fundraiser to benefit MS. Twelve participants with and without a connection to MS were randomized into two groups to complete the training program. Along with the 5K training, participants in the experimental group engaged in an MS education intervention. All participants received weekly email check-ins from the program facilitator and online training resources. Upon completion of the program, a monetary donation was given to the National MS Society in the participant's name. Preliminary results indicated groups that participated in the MS education intervention were more likely to complete the program. Furthermore, participants with a personal connection to the cause had lower dropout rates. Participants without MS noted their struggles for participation were weather and holiday scheduling conflicts. Participants with MS stated energy and fatigue as top struggles for sustaining motivation to complete the program. Overall, participants reported they enjoyed the program and felt it was beneficial for sustained PA participation. Future program improvements should consider factors related to time of year for implementation. By creating a connection to MS, this program demonstrated the ability to positively impact PA behavior of participants.

Physical Inactivity or Exercise? A Simple Decision Test Predicts Exercise Behavior Over the Next 14 Days

Ralf Brand, University of Potsdam; Sinika Timme, University of Potsdam

Affective-Reflective Theory (ART) of physical inactivity and exercise posits a continuous interaction between an automatic affective type-1 and a reflective type-2 process, leading to either a more impulsive (type-1) or intentional (type-2) decision to change or maintain a current behavioral state (Brand & Ekkekakis, 2018). Reaction time-based tests or (psycho)physiological measurements have been used to operationalize the type-1 process. Type-2 processes can be depicted with questionnaires. No tested method has yet been available for measuring decision tendencies. For this study, we had 110 individuals (aged 18 to 52 years, 68 female and 42 male) make choices with a simple computer-based test. They were asked to decide between physically inactive and exercise-related behavioral alternatives, randomized from a pool of 17 images each. Based on this, a score on decision tendency was calculated. Over the next two weeks, a standardized mini-questionnaire was administered every evening via smartphone to ask whether the participant had exercised that day. Regression models and closer correlation analysis revealed significant predictive power of the decision score for moderate-to-vigorous physical exercise minutes over the next 14 days ($r_{\text{winsorized}} = .43$, $CI95\%$ [0.26, 0.57]).This decision test provides an alternative or addition to other measurements of exercise behavior. It avoids common-method bias in empirical investigations of the ART (and other studies), and can be easily adapted to test, for example, the effect of psychological states on exercise-related decisions in dual-task paradigms.

Talent Selection in Sports and Business – A Citation Network and Content Analysis

Birte Brinkmöller, University of Muenster; Dennis Dreiskämper, University of Muenster; Bernd Strauss, University of Muenster

Sports clubs and associations, as well as business enterprises, strive to attract the best talents through various selection procedures. While in the business context different constructs and procedures for personnel selection are empirically considered, in the sports context the focus is on talent selection. However, besides some differences, such as cognitive vs. physical prerequisites for positions in both contexts, commonalities, such as motivation in relation to future success, can be found (Penney et al., 2011). Despite the increasing number of publications suggesting a connection between the two contexts, it is so far an open question whether and how the findings of the subject domains are linked. The goal is to examine to what extent and at what levels of abstraction (theories, methods, etc.)

HRD and talent selection differ in terms of their scientific findings and what possibilities this opens up for the sports context. A systematic literature search was conducted in the SCOPUS and Web of Science databases and suitable articles (according to PRISMA 2020 statement) were identified in a double-blind procedure. Subsequently, a citation network analysis is performed and interconnectivity is calculated (cf. Emich et al., 2020). Content categorization of abstraction levels is performed using a probabilistic topic-modeling procedure. The systematic literature search resulted in several 18,788 hits, which were reviewed by independent experts. The distribution between the fields already suggests a clear predominance in favor of the economic context ($n_{Scopus;business.}$ = 6.046; $n_{Scopus;sport.}$ = 1.065; $n_{WoS;business.}$ = 6.572; $n_{WoS;sport.}$ = 5.105). At this time the data is being analyzed and the citation network will be built. Furthermore, the interconnectivity between the fields will be calculated on different levels. Theoretical and practical implications for future work will be derived from the results. In addition, concrete topics will be identified in which the sports context can make greater use of the findings of the business context.

Psychosocial Correlates of Device-Measured Physical Activity Behavior Among Youth With Epilepsy

Denver Brown, University of Texas at San Antonio; Shiyu Li, University of Texas Health Science Center at San Antonio; Carah Porter, University of Texas at San Antonio; Gabriel Ronen, McMaster University; Kelly Arbour-Nicitopoulos, University of Toronto; John Cairney, University of Queensland

Evidence has consistently shown that youth with epilepsy (YWE) engage in less physical activity than population norms. Consequently, many YWE forego the mental health benefits that physical activity is known to confer, which may be critical for this population given their increased risk of mental health problems. Identifying correlates of physical activity behavior among YWE is therefore of importance for promoting a physically active lifestyle and can inform the development of effective interventions. The purpose of this study was to explore psychosocial determinants of physical activity behavior among YWE. Nineteen YWE aged 8 to 17 years (Mean age = 12.42 ± 0.73, 47% female) and their parents completed the study. Moderate to vigorous physical activity (MVPA) behavior was measured using accelerometers (ActiGraph GT3X). YWE completed Multi-Process Action Control Framework measures of reflective, regulatory, and reflexive processes related to their MVPA behavior. Parents completed a measure assessing their physical activity support behaviors. Pearson correlation coefficients were computed for youth MVPA and each of the psychosocial variables. On average, YWE engaged in 47.46 ± 5.55 min of MVPA per day. Correlation analyses showed perceived opportunity (r = 0.52) and capability (r = 0.34) were the strongest predictors of youth MVPA. Small associations with youth MVPA were observed for affective attitudes and identity (both r's = 0.23) as well as parent physical activity support behaviors (r = 0.16). At the intrapersonal level, these results suggest reflective processes – aspects of perceived behavioral control, in particular – as well as identity may be important determinants of MVPA among YWE. Evidence also indicates that parent physical activity support behaviors play a modest role deserving of attention within interventions aiming to increase MVPA among YWE. Nevertheless, future research using a larger and more diverse sample of YWE is required to better understand intrapersonal and interpersonal predictors of physical activity behavior for this population. Funding source: University of Toronto Internal Kinesiology and Physical Education Faculty Research Grant.

A Self-Led Nordic Walking Program for Adults With Parkinson's Disease: An Exploratory Qualitative Study of Participants' Experiences

Jennifer Brunet, University of Ottawa; Meghan McDonough, University of Calgary; Julie Nantel, University of Ottawa

Nordic walking is similar to brisk walking, but with the individual holding two poles, actively engaging muscles of the upper body. In adults with Parkinson's disease (PD), Nordic walking can improve postural stability, decrease freezing of gait, and increase balance, strength and flexibility in the lower limbs. With its gaining popularity, Nordic walking can provide an opportunity for adults with PD to increase (or maintain) physical activity levels, which is important for mitigating PD symptoms and promoting quality of life. This exploratory qualitative study investigated the experiences of adults with PD who participated in a self-led Nordic walking program, including the perceived impact of the program on their physical activity motivation, behaviour, and quality of life. Within 1 year of completing a 6-week, unsupervised Nordic walking program consisting of 3 weekly 30- to 45-minute walking sessions, 8 adults (mean age=65.9 years) with PD were interviewed face-to-face. The interviews were audio-recorded and transcribed verbatim. Thematic analysis of the data through the lens of self-determination theory identified 3 main themes: (1) *a catalyst for change in physical activity*, (2) *offers physical and mental health benefits,* and (3) *helps develop physical self-awareness and self-confidence*. Although the self-led approach allowed for easy incorporation into everyday life, participants also raised the importance of having a group as a supportive resource. Overall, the results offer insight into how adults with PD experience a self-led Nordic walking program and suggest it may lead to positive outcomes, including increased physical activity motivation, behaviour, and quality of life. The range of physical and mental health benefits experienced suggests continued investigations are warranted to support its integration in practice. However, future research should seek to examine how this self-led Nordic walking program could be modified to a group-based (or mixed individual/group) program.

A Model for Crises in Team Sports

Stephanie Buenemann, University of Muenster; Charlotte Raue-Behlau, University of Muenster; Katherine Tamminen, University of Toronto; Bernd Strauss, University of Muenster

When sports teams unexpectedly underperform continuously, news often label this as crises. Despite common use of the term, no valid theoretical foundation exists. The aim of this contribution is to close this gap. Although sport psychology has addressed performance slumps in a number of ways, an overarching theory and model for explaining processes and mechanisms on how crises across multiple games develop is lacking (see e.g., Stead et al., 2022). Psychological phenomena e.g., choking under pressure (Beilock & Carr, 2001), Psychological Performance Crisis (Bar-Eli & Tenenbaum, 1989) and negative momentum (Taylor & Demick, 1994), address single effects and highlight the individual. We define a team crisis as a downward spiral of threats accompanied by lasting underperformance, based on definitions from other fields (Billings et al., 1980; Bundy et al., 2017; Coombs, 2014; Pearson & Clair, 1998), as well as psychological stress theories (Blascovich & Tomaka, 1996; Jones et al., 2009; Lazarus & Folkman, 1984; Sweeny, 2008). The proposed model is divided into two stages: the crisis trigger and the crisis process. First, a negative situation influences the perception of upcoming tasks as threatening. Specifically, high expectations, high consequences and uncontrollable attributions lead to threat appraisals (based on Sweeny, 2008). As personal chracteristics influence appraisals (Blascovich & Tomaka, 1996), the model adapts this idea by including team characteristics as moderating factors on threat appraisal. Further, athletes experience negative, debilitative emotions (Meijen et al., 2020) and use fewer coping strategies than required in threat states (McGreary et al., 2020). Due to social consequences of emotions (Tamminen & Gaudreau, 2014), inefficient emotion regulation may in turn influence the team's dynamic and further threat appraisals are more likely. Both research and practice will benefit from a crisis model in order to understand underperformance, and to provide

insights for identifying and preventing crises in teams, as well as potential interventions.

Group Norms in Sport: Areas for Future Research

Alex Cai, McGill University; Jordan Lefebvre, McGill University; Danielle Alexander, McGill University; Gordon Bloom, McGill University

Group norms are a set of behavioral expectations that are applied to and shared by all group members. In sport, group norms have been shown to promote positive team processes, such as communication and cooperation, as well as positive team outcomes such as performance, collective efficacy, and team dynamics. Although group norms have been shown to facilitate positive team dynamics, there remains a lack of literature investigating the relationship between group norms and team member behavior in sport. This gap in the literature diminishes the utility of group norms in sport, potentially overlooking a valuable tool for athletes, coaches, and practitioners to improve team outcomes. Drawing on existing research from sport and non-sport disciplines, this presentation suggests three areas of future research for group norms in sport. First, researchers should investigate factors that moderate the influence of group norms on team members' behaviors. Understanding how group norms are impacted by contextual factors, such as group size, age (youth, teen, adult), and competitive level (recreational, high-performance, elite), would allow practitioners to adapt group norms usage to different contexts. Second, researchers should clearly define positive and negative attributes for group norms. Currently, it is not clear what constitutes a productive group norm and having an unambiguous definition would allow team members to evaluate and adapt unproductive group norms. Third, considering the majority of group norms literature focuses on how team leaders shape group norms, researchers may investigate how informal leaders and/or non-team leaders (e.g., rookies, alternates) contribute to group norms. In addition to team leaders, general members may also play a role in developing, perpetuating, and maintaining group norms. Taken together, this presentation provides an overview of existing group norms literature and suggests areas in need of further research to further the study of human behavior in sport.

Understanding Coaches' Reflections on Adult Oriented Psychosocial Coaching Practices

Bettina Callary, Cape Breton University; Catalina Belalcazar, University of Ottawa; Ciera Disipio, Cape Breton University; Derrik Motz, University of Otttawa; Scott Rathwell, University of Lethbridge; Bradley W. Young, University of Ottawa

The Adult Oriented Sport Coaching Survey (AOSCS; Rathwell et al., 2020), a 22-item, five factor survey, was developed as a psychometrically validated and empirically grounded self-assessment tool to assess key psychosocial coaching practices for coaches who work with adult athletes. Callary et al. (2020) positioned the AOSCS as a tool for coach learning and reflection, yet its practical utility for coaches remains anecdotal. Thus, this study explored coaches' perspectives of the AOSCS as a self-assessment tool in reflecting on their approaches for coaching Masters athletes (MAs). Thirteen Canadian coaches (9 women/4 men, aged 59-78 years) from six sports (bowls, speed skating, figure skating, trampoline, swimming, equestrian) completed the AOSCS prior to watching a webinar regarding the research on coaching MAs and the development of the AOSCS. Each was subsequently shared a copy of their AOSCS results and interviewed about their perceptions of the relevance and utility of the AOSCS. Interviews were analyzed using reflexive thematic analysis (Braun & Clarke, 2021), which resulted in three higher-order themes and 14 sub-themes, including the coaching context, the perceived relevance of the AOSCS, and its use in coach development. The results indicate that the coaches reflected on their actions according to the five factors of the AOSCS, and that the AOSCS was relevant in various contexts, including individual or group settings, across age categories, and in various competitive orientations. The coaches were interested in gaining others' perspectives on the AOSCS because their individual scores were difficult to interpret without baseline measures, and as a result they found the debrief interview to be a worthwhile strategy to make sense of their scores. Overall, the AOSCS is relevant for coaches to use in reflection on their approaches as they can consider several ways to coach MAs depending on their context. Funding: SSHRC Funding source: Social Sciences and Humanities Research Council of Canada.

Predictive Factors of at Least One Versus Three or More Persistent Symptoms After Concussion in Youth Athletes

Madison C. Chandler, The University of North Carolina at Chapel Hill; Christine E. Callahan, The University of North Carolina at Chapel Hill; Josh Bloom, Carolina Family Practice & Sports Medicine; Janna Fonseca, Duke University; Kristen Ramsey, Carolina Family Practice & Sports Medicine; Valerie J. DeMaio, The University of North Carolina at Chapel Hill; Johna K. Register-Mihalik, The University of North Carolina at Chapel Hill

Persistent symptoms after concussion is defined as the presence of 3 or more concussion symptoms at least 1 month after injury–sometimes called post-concussive syndrome (PCS). Recent data suggest this 3+ symptom group is unique: individuals are more likely to experience emotion-related difficulties compared to those reporting just 1-2 persistent symptoms. The purpose of this investigation was to determine individual-level predictors of reporting 1+ vs. 3+ persistent concussion symptoms to further delineate clinical considerations for varying persistent symptom burden. Participants were seen in a community clinic within 72 hours of concussion, where they provided informed consent & demographic information. Initial symptom reports were assessed via the Post-Concussion Symptom Scale, 26 items rated on a scale from 0 (None) to 6 (Severe). One month post-injury, parents completed the Rivermead Post-Concussion Questionnaire (RPQ), 18 items measuring symptom presence & severity rated on a scale from 0 (Not experienced at all) to 4 (A severe problem). Children with valid symptom data from the follow-up period were used for analysis ($N = 236/245$; $M_{age} = 14.3 \pm 2.1$ years). Outcome variable groups comprised those who rated 1+ ($N = 170$) and 3+ ($N = 62$) RPQ symptoms as worse than at initial visit. Separate univariate logistic regression analyses were conducted to determine individual-level predictors of group membership. Females (B's ≥ 0.66, $ps < .03$; ORs > 1.9) & those with higher initial total symptom score (Bs ≥ 0.03, p's $< .01$; ORs ≥ 1.03) were more likely to report 1+ and 3+ RPQ symptoms. Initial symptom clusters were then examined as predictors. Cognitive-Migraine-Fatigue cluster score was predictive of both outcome variables (Bs ≥ 0.05, $ps < .001$; ORs ≥ 1.05). For the 3+ group–but not for the 1+ group–Affective cluster score was a predictor ($B = 0.16$, $p = .01$; $OR = 1.17$). Initial affective symptoms (e.g., sadness, nervousness) may be predictive of the presence of 3+ persistent concussion symptoms–suggesting that they could be a potential target in interventions to reduce the burden of PCS. Funding source: National Operating Committee on Standards for Athletic Equipment (NOCSAE).

An Examination of Physical Activity Guidelines and Health-Related Quality of Life Among Older Adults

Sisi Chen, Michigan State University; Leapetswe Malete, Michigan State University; Jiying Ling, Michigan State University

Physical activity can help improve the poor health-related quality of life in older adult population. Although the Physical Activity Guidelines for Americans recommend both aerobic and muscle strengthening activities

for adults, previous studies predominantly focused on aerobic activity with limited research on muscle strengthening activities. The purpose of this cross-sectional study was to examine the relationships between meeting physical activity guidelines (i.e., aerobic activity, muscle strengthening activity) and health-related quality of life in the older adult population. Data of 87,495 older adults aged ≥ 65 years from the U.S. 2019 Behavioral Risk Factor Surveillance System were analyzed. Phone interviews and validated questionnaires were used to assess aerobic activity, muscle strengthening activity, and health-related quality of life. Binomial logistic regression was used to examine the associations between meeting physical activity guidelines and health-related quality of life while adjusting for key covariates (i.e., age, sex, race, education, marital status, employment status, income, body mass index, smoking, drinking, and comorbidities). Participants meeting both or aerobic activity guideline only had significantly lower odds of reporting all components of health-related quality of life (i.e., general health, mental health, physical health, activity limitation) than those who met neither guideline (OR = 0.37-0.58) and those who met muscle strengthening activity guideline only (OR = 0.34-0.74). Given the stronger positive association between aerobic activity and health-related quality of life than that between muscle strengthening activity and health-related quality of life, future research should focus on promoting aerobic activity to increase health-related quality of life among older people.

Physical Activity and Body Mass Index Were Interactively Related to Health-Related Quality of Life Among Older Adults

Sisi Chen, Michigan State University; Jiying Ling, Michigan State University; Yu Cheng, Michigan State University

Physical activity (PA) and weight status are individually linked to health-related quality of life (HRQoL) in older adults. However, no study to date has examined the interactive associations of combined aerobic and muscle-strengthening activities and weight status with HRQoL in older adults. The purpose of this study was to examine how meeting PA guidelines (i.e., aerobic activity, muscle strengthening activity) and weight status (i.e., underweight, normal weight, overweight, and obese) were interactively related to HRQoL among older adults. A cross-sectional analysis was conducted using data from 87,495 older adults aged 65+ years who participated in the U.S. 2019 Behavioral Risk Factor Surveillance System. PA, weight status, and HRQoL were assessed by validated questionnaires via phone interviews. Binomial logistic regression models were used to examine the interactive effects of meeting PA guidelines and weight status on the odds of having poor HRQoL after controlling for key confounders (age, sex, race/ethnicity, education, marital status, income, employment, alcohol consumption, smoking, and comorbidities). Compared to participants meeting both PA guidelines and with normal weight, both underweight and obese older adults had significantly higher odds of having poor general health (OR = 1.55-6.16) regardless of meeting PA guideline status, and those meeting muscle strengthening activities only or meeting neither PA guideline reported higher odds of reporting poor physical health (OR = 1.83-6.22) irrespective of weight status. Relative to participants meeting both PA guidelines and with normal weight, those meeting neither PA guideline had significantly higher odds of having poor mental health (OR = 1.69-2.78) regardless of weight status, and those meeting muscle strengthening activities only or meeting neither PA guideline reported higher odds of having frequent activity limitation days (OR = 2.18-7.05). Results from this study support the promotion of aerobic PA and healthy weight to improve HRQoL in older adults.

How Did I Do? The Role of Self-Compassion in Athletes' Response to Performance Feedback

Danielle L. Cormier, University of Saskatchewan; Yasamin Alipour Ataabadi, University of Saskatchewan; Kent C. Kowalski, University of Saskatchewan; Alison R. Oates, University of Saskatchewan; Leah J. Ferguson, University of Saskatchewan; Joel L. Lanovaz, University of Saskatchewan

Extant evidence suggests that feedback can significantly improve sports performance, yet receiving and executing feedback can be challenging for some athletes. Athletes who are equipped with particular psychological dispositions and strategies might be better prepared to cope with and apply performance feedback than their peers. This study explored how self-compassion and other psychological variables (i.e., self-esteem, self-criticism, and concern over mistakes) were associated with athlete responses to objective biomechanical-based performance feedback. Our secondary purpose was to investigate whether self-compassion impacts performance. Fifty athletes (22 females; $M_{age} = 19.8$ years; $SD = 3.1$; and 28 males; $M_{age} = 23.6$ years; $SD = 7.8$) participated in this study. After completing several measures (i.e., an athlete-specific version of the Self-Compassion Scale, a sport-specific version of the Rosenberg Self-Esteem Scale, the State Self-Criticism measure, and the Concern Over Mistakes subscale of the Sports Multidimensional Perfectionism Scale-2) each participant performed four sets of 40-meter sprints while being provided biomechanical feedback after each sprint trial. Afterwards, athletes completed questionnaires that asked about their emotions, thoughts, and reactions about receiving feedback. Self-compassion was positively correlated with self-esteem ($r = .57$, $p < .01$) and negatively related to both self-criticism ($r = –.52$, $p < .01$) and concern over mistakes ($r = –.69$, $p < .01$). Athletes with higher levels of self-compassion prior to sprint performance experienced less self-critical thoughts following biomechanical feedback and subsequent sprint trials ($r = –.38$, $p < .01$). A moderated regression analysis between the first and fourth sprint trials revealed that self-compassion was not a moderator for change in sprint performance ($R^2 = .64$, $\Delta R^2 = .10$, $p > .05$). These results suggest that self-compassion can play a nuanced role in athlete coping and sport performance. Funding source: N/A.

Feasibility and Acceptability of a Peer-Led Group-Based Virtual Exercise and Psychoeducation Program for University Students With Depression

Vanessa Coulbeck, Western University; Claire Adams, Western University; Eva Pila, Western University

More than 1 in 4 university students report being diagnosed or treated for a mental health condition in the past year, and up to 70% report depressive symptoms that make it difficult to function academically. This ubiquity of mental health concerns has placed an immense demand on campus mental health services, thereby urging feasible and accessible campus-based programs that can support student mental health. Peer-to-peer support for eligible participants may provide far-reaching scalable methods that is feasibly embedded and maintained in the university context. The purpose of the present investigation was to examine the feasibility and acceptability of a 10-week 30-session peer-led group-based virtual exercise and psychoeducation program for university students diagnosed with depression. Feasibility criteria included recruitment and eligibility, retention and adherence, and capacity for peer delivery. Acceptability was assessed with a post-intervention questionnaire. Over an 18-month period, 390 students were referred or self-referred, and 98 students were screened for eligibility. Of the students screened, 52% met eligibility criteria and enrolled in the intervention. Participants were randomized into three arms: exercise only ($n = 15$); exercise + self-compassion ($n = 17$); exercise + behavioral coaching ($n = 19$). Of the participants randomized, 84% completed the intervention and post-intervention survey. The average session adherence rate was 69%. Thirteen peer facilitators were trained, attended weekly supervision meetings, and delivered the intervention to 13 groups of participants. This pilot study provides preliminary support for the feasibility and acceptability of this intervention and identifies areas of

improvement in advance of a definitive randomized controlled trial. The knowledge gained from this pilot study promises to enhance capacity for delivery of scalable campus-based mental health services which may be broadly transferrable to university campuses.

Social Support Behaviours and Barriers Experienced in Online Exercise Classes for People Living With Cancer

Bobbie-Ann P. Craig, University of Calgary; Meghan H. McDonough, University of Calgary; S. Nicole Culos-Reed, University of Calgary; William Bridel, University of Calgary

Social support is an important component of group-based exercise programs for people living with cancer. Due to the COVID-19 pandemic, many of these classes have moved to online delivery, but there is limited knowledge regarding how social support can be fostered in this context. Guided by social support theory (Feeney & Collins, 2015), the purpose of this study was to examine what behaviors individuals living with cancer perceived as supportive in the online exercise environment, as well as any barriers they experienced. Interviews were conducted with people living with cancer ($N = 19$) who participated in online group exercise oncology classes. Data analysis was guided by interpretive description methodology. Three themes were identified: creating a welcoming atmosphere, helping improve exercise ability and reach goals, and providing opportunities to build relationships. Specific supportive behaviors and barriers to social support were identified within these themes that represents the functions of those behaviors. Participants felt a welcoming atmosphere was created when the group engaged in conversation, was open and willing to share, was positive or upbeat, communicated an understanding of cancer, and was inclusive. The exercise class helped participants improve their exercise ability and reach their goals through commitment and connection, mastering or improving their skills, providing informational support, and providing encouragement. The exercise class also provided an opportunity to build relationships through facilitated social interaction and informal development of relationships. These findings identify behaviors and barriers that can aid exercise program developers in structuring their online classes, as well as inform strategies for fitness professionals to use in the online environment to foster social support. Ultimately, using social support to enhance participant experience positively impacts exercise adherence and the potential beneficial outcomes of these programs.

Examining the Delivery of Motivational Interviewing and Behavior Change Techniques in an mHealth Exercise Intervention for Adults With Type 2 Diabetes

Kaela Cranston, University of British Columbia; Megan MacPherson, University of British Columbia; Tineke Dineen, University of British Columbia; Ali McManus, University of British Columbia; Matthew Cocks, Liverpool John Moores University; Jonathan Low, University of British Columbia; Katie Hesketh, Liverpool John Moores University; Mary Jung, University of British Columbia

The primary focus on efficacy within physical activity interventions impedes implementation outside of the research context. *P*-values and effect sizes alone do not provide necessary information on *how* an intervention might be translated into a different context. Comprehensive reporting of active ingredients within an intervention, coupled with intervention fidelity must be addressed at the early stages of trial design to improve implementation. The purpose of this work was to code active intervention components (behavior change techniques [BCTs] and motivational interviewing [MI] techniques) used within MOTIVATE T2D and examine the extent to which coaches implement the intervention as intended. MOTIVATE T2D is an ongoing randomized pilot study assessing if mobile health technology can improve exercise adherence among individuals with type 2 diabetes. Exercise coaches meet one-on-one with participants in both an exercise counselling control group and an exercise counselling plus mobile health group. Coaches received brief MI training and were provided with session scripts to ensure consistency between groups. Three independent reviewers coded the BCTs and MI techniques in all session scripts. The reviewers then coded a random selection of audio recordings of each of the sessions delivered by the exercise coaches. Session scripts contained 3-14 BCTs and 4-11 MI techniques. Audio recordings contained 3-7 BCTs and 4-11 MI techniques that were in the scripts, and 2-4 BCTs and 1-3 MI techniques that were not in the scripts. To determine the effectiveness of the MOTIVATE T2D pilot study, delivery fidelity must be critically considered. Before progressing to a randomized controlled trial, changes to the scripts and coach training can be made to help improve delivery fidelity. Broadly, comprehensive reporting and adequate fidelity can enable more accurate interpretation of research findings, thus allowing for successful interventions to be more accurately and easily implemented into different contexts. Funding source: CIHR.

What's the Lineup? The Selection and Sequencing of Mental Skills for a PST Program

Samantha D'Agostino, University of Windsor; Frank Ely, University of Windsor; Melissa Paré, University of Windsor; Krista Munroe-Chandler, University of Windsor

Psychological skills training (PST) involves the delivery of one or more mental skills (e.g., imagery) in a systematic manner, with the goal of enhancing the performance and/or enjoyment of athletes (Weinberg & Gould, 2015). When a PST program includes multiple mental skills (i.e., packaged PST; e.g., imagery and self-talk), these skills are thought to complement each other and, in turn, provide an additive effect on performance (Gregg et al., 2004; Thelwell, 2008). However, little is known regarding the order in which mental skills are best delivered (i.e., sequencing) within a packaged PST program (Martens, 1997; Thelwell, 2008). Thus, practitioners are challenged with not only the selection of mental skills but also the sequencing of such skills. As such, the purpose of the present study was twofold: (a) to examine the sequence in which mental skills are delivered within published packaged PST research, and (b) to develop a pathway to guide the selection and sequence of mental skills within a packaged PST program. Over 70 published journal articles, books, and book chapters related to packaged PST programs were reviewed to inform the development of the proposed *Mental Skills Pathway*. This pathway consists of three distinct phases, each encompassing unique mental skills: (1) Foundation Phase (i.e., goal setting), (2) Development Phase (i.e., imagery and self-talk), and (3) Performance Phase (i.e., arousal regulation, attentional control, and emotional control). Mental skills learned in one phase serve as building blocks for those delivered in subsequent phases, thus encouraging the continued development of mental skills. Although more research is needed to examine the *Mental Skills Pathway* within a sport context, this pathway offers practitioners a guide for selecting and sequencing mental skills when designing packaged PST programs.

Feasibility and Outcomes of a Universal School-Based, Mental Health Program (ALLY) Delivered to 5th and 6th Grade Students in a Rural Title 1 School

Adefunke DadeMatthews, Auburn University

Children and adolescents exposed to adverse childhood experiences (ACEs) are more likely to experience chronic stressors, predisposing them to mental health disorders. Individuals from low socioeconomic status

(SES) backgrounds are more likely to experience ACEs and disproportionately experience mental health problems. The present study examined the feasibility of the Advocates for All Youth (ALLY) program, a six session (30-minutes/week) universal school-based program aimed at increasing resilience and self-efficacy via individualized sessions in students from a predominantly Black, low SES, and rural community in Alabama. A total of 82 students were randomized into the ALLY intervention ($n = 40$) or waitlist control group ($n = 42$). Students in the ALLY group met individually with a facilitator to discuss health concepts and complete workbook activities. 31 children in the ALLY group completed all six sessions and provided complete data, 32 children in the control group provided complete data. Modifications were implemented during the program in response to the sample's low health literacy and general literacy, including adjusting pre/post-test administration, simplifying the language of the student workbooks, and providing additional activities for the mindfulness component. Although the program was logistically feasible and well-accepted by the participants and ALLY facilitators, no differences in self-reported anxiety, depression, resilience, self-efficacy, or physical activity were observed between the ALLY and control groups. Thus, despite the implemented program modifications, the 6-session intervention was not sufficient to improve this at-risk population's mental or physical health. Future studies implementing ALLY will also include 1 hour of health literacy education for all children before pre-testing, reducing the number of assessments, adding a student "homework" book to correspond with session activities, adding mindfulness to all sessions, and a fidelity assessment to ensure consistency across ALLY facilitators, which may increase the program's impact.

Quality of Life, Device Satisfaction, and Functional Status of Lower Limb Prostheses Clients

Oluwagbemiga DadeMatthews, Auburn University; Jaimie Roper, Auburn University; Adan Vazquez, Alabama State University; David Shannon, Auburn University; JoEllen Sefton, Auburn University

Limb loss significantly alters the quality of life and the overall health of individuals and families affected, imposing a tremendous economic burden. Past research has shown that about half of lower limb amputees are not satisfied with their prostheses for diverse reasons despite advances in prosthetic device technology, often resulting in abandonment of their device out of frustration. Most of these studies used small sample sizes, instruments not validated in the amputee population, and a limited diversity of participants. We conducted an online survey using three validated instruments on a diverse group of lower limb amputees ($N = 1736$) recruited via several online amputee advocacy platforms. More civilians (67.5%) than veterans (21.8%) and active-duty soldiers (10.7%) responded to the surveys. The majority were males (60%), Caucasians (78%), and young adults (90%) with trauma-related lower limb amputations (78.2%). About half of the amputees reported dissatisfaction with their device (49%), prosthetic service (49%), health-related quality of life (49%), and lower extremity functional status (48%). Multiple regression was used to examine predictors of client satisfaction after controlling for effects of race, socioeconomic status, and level of education. The health-related quality of life, lower extremity functional status, activity-specific balance scale, and modified falls efficacy scale significantly predicted client satisfaction with prosthetic device ($\beta = 32.56$, $F(25, 1710) = 61.00$, $p < .0005$, $R2 = .47$). All predictors added statistical significance to the prediction, $p < .005$). Our findings reinforce the need for more representation of individuals from low socioeconomic status and minority populations in evaluating prosthetic rehabilitation. An in-depth assessment of lower limb prostheses clients ' perspective is necessary to improve satisfaction with prosthetic prescription, service, and overall rehabilitation outcomes. Funding source: Warrior Research Center, School of Kinesiology, Auburn University.

Global and Local Motion Processing and Expertise During Anticipation in Sport

Brady S. DeCouto, University of Utah; Peter C. Fino, University of Utah; Keith R. Lohse, Washington University; Sarah H. Creem-Regehr, University of Utah; David L. Strayer, University of Utah; Trafton Drew, University of Utah; Nicholas J. Smeeton, University of Brighton; A. Mark Williams, Florida Institute for Human and Machine Cognition

Experts possess superior anticipation, largely attributed to the global pick-up of biological motion information. Thus, experts may process movement more globally, simultaneously extracting information across multiple body segments. Conversely, novices may process movement more locally, relying on serial perception of individual body segments. Brain oscillatory frequencies can index global (right parietal activity) and local (left parietal activity) distribution of attention. In this experiment, we examined attentional distribution during anticipation of soccer penalty kicks using neural metrics and viewing conditions that emphasize global or local information. Expert ($N = 21$, $M_{age} = 29.8 \pm 8.5$) and novice ($N = 19$, $M_{age} = 28.2 \pm 5.0$) soccer players anticipated shot location when viewing videos of penalty kicks that were temporally occluded at football contact under normal, blurred, or spatially occluded (only showing the hips) viewing conditions. EEG data (alpha and beta power) were collected. Mixed design ANOVAs were used to analyze performance accuracy and EEG data. Experts performed better than novices ($p = .007$, $d = .510$), but no interactions were found between skill and conditions ($p = .416$, $d = .247$). Experts showed greater right parietal beta power than novices ($p = .030$, $d = .063$), but no differences emerged for alpha power across skill ($p = .852$, $d < .001$). Finally, beta and alpha power differences ($\beta - \alpha$) were greater in right parietal regions for experts and in left parietal regions for novices ($p < .001$, $d = .252$). In parietal regions, beta power has been related to cortical excitability and alpha power to attentional inhibition. Our results suggest that experts are more likely to engage right parietal regions while novices favor left parietal regions, which may facilitate global and local processing, respectively. During time-constrained tasks, global processing of movement may be particularly helpful depending upon the observer's expertise. In future, researchers may focus on examining relationships between these neural signatures and performance.

Transition Factors, Sport-Related Injury Histories, and Life Satisfaction in Former Collegiate Women's Soccer Athletes

J.D. DeFreese, University of North Carolina at Chapel Hill; Erianne Weight, University of North Carolina at Chapel Hill; Kevin Carneiro, University of North Carolina at Chapel Hill; Aliza Nedimyer, University of North Carolina at Chapel Hill; Samuel Walton, University of North Carolina at Chapel Hill; Jamie DeCicco, Cleveland Clinic Lerner College of Medicine; Jason Mihalik, University of North Carolina at Chapel Hill; Zachary Kerr, University of North Carolina at Chapel Hill; Avinash Chandran, Datalys Center for Sports Injury Research and Prevention

The psychological health and well-being of former female athletes is an important public health topic and has not yet been studied extensively. Theoretically founded (e.g., Wylleman et al., 2004) research is needed on how transition factors (i.e., transition planning, identity concerns) and sport-related injury histories impact well-being outcomes (i.e., life satisfaction) following the transition from women's sport. The present study examined associations among transition factors, sport-related injury histories and post-sport life satisfaction in a sample of former elite women's soccer athletes. We hypothesized that, after accounting for injury histories, having a transition plan would be positively associated with life satisfaction scores; whereas, having identity concerns regarding transition would

be negatively associated with life satisfaction scores. Participants were drawn from a sample of former American Division I collegiate varsity women's soccer athletes [$n = 101$; M=42.9±12.4 years; 97 (96%) White/Caucasian]. Participants self-reported on previously validated assessments of pre-transition planning (1 yes/no item), identity concerns related to transition (1 yes/no item), injury history (counts of musculoskeletal and concussion injuries), life satisfaction, and demographics. Following data screening, a multivariable regression analysis was fitted to probe study hypotheses. When accounting for both musculoskeletal and concussive injury counts, our results demonstrated that the presence of identity concerns regarding transition ($\beta = -0.38$, $p < .001$), but not pre-transition planning ($\beta = 0.07$, $p = 0.56$), significantly predicted current life satisfaction scores ($F_{(4,82)} = 4.43$, $p = .003$, $R^2 = 0.18$). Partially supporting study hypotheses, transition-related identity concerns were a salient factor for former collegiate women's soccer athletes' post-sport well-being. These findings may inform prospective research on the impact of athletic identity across the sport transition window, as potential exists for future identity-focused intervention development. Funding source: Matthew Gfeller Center.

Physical Recreation and Associations Between Campus Climate, Physical Activity, Mental Health, and Academic Achievement Among Post-Secondary Students

Melissa L. deJonge, University of Toronto; Amy E. Nesbitt, University of Toronto; Catherine M. Sabiston, University of Toronto

Physical recreation (defined as engagement in organized athletics including intramurals, varsity sports, and club/community sports) has been identified as an activity within the post-secondary setting to promote mental health, well-being, and academic achievement. Yet, mechanisms that may facilitate these outcomes are not largely understood. Enhanced physical activity (PA) engagement and perceptions of a healthy campus climate (CC) may be part of a comprehensive model of campus well-being. The present study examined the direct and indirect effects of engagement in physical recreation and associations with CC, PA, mental health outcomes, and academic achievement. Path analysis was conducted using cross-sectional data from the Canadian Campus Well-Being Survey ($N = 4{,}897$; $M_{age} = 21.16 + 3.81$ years; 72% women). The model explained 31% of the variance in well-being, 19% of the variance in psychological distress, and 47% of the variance in academic achievement. Physical recreation was directly associated with CC ($\beta = .06$, $p < .001$), PA ($\beta = .06$, $p < .001$), well-being ($\beta = .09$, $p < .001$), and distress ($\beta = -.07$, $p < .002$). There was no significant direct effect between physical recreation and academic achievement. Physical recreation had a significant indirect effect on well-being and academic achievement through CC and PA ($ps < .05$). There was a significant indirect effect of physical recreation on psychological distress through CC ($p < .001$). These results provide support for the contribution of physical recreation in promoting mental health and academic achievement through CC and PA as mechanisms that may facilitate positive outcomes. Focusing on physical recreation as an intervention approach to promote mental health and a healthy CC within a post-secondary context may be important.

Negative Peer Relationships in Youth Physical Activity: A Systematic Review

Anthony G. Delli Paoli, Rutgers, The State University of New Jersey

Relationships with peers are an important part of youth development and the promotion of physical activity. Understanding of peer relationships in physical activity settings largely focuses on the positive aspects of peer relationships (i.e., acceptance, friendships) whereas knowledge about negative peer relationships remains limited. Drawing from Leary (2001), negative peer relationships are relationships where an individual perceives a decrease in value or devaluation. Accordingly, the purpose of this study is to understand the state of the literature on negative peer relationships in youth physical activity settings. A literature search of CINAHL, The Cochrane Library, PsychINFO, PubMed, SPORTDiscus, and Web of Science produced 48 papers that met inclusion criteria. Results showed a variety of negative peer relationship constructs studied among a variety of youth populations with bullying, peer rejection, and teasing being the most common. These were linked to maladaptive psychosocial outcomes and poorer physical activity experiences. Overall, negative peer relationships present challenges for individuals to enter physical activity contexts, on-going participation and return to participation.

Healthy Lifestyles or Exercise Addiction? Understanding the Experiences of Lifestyle Sports Participants Through the Lens of Heterotopias

Jacob Dinardi, San Francisco State University; Nicole Bolter, San Francisco State University; Maria Veri, San Francisco State University

Alternative sports constructed around subcultural communities that emphasize individual expression and achievement have been described as lifestyle sports, for example, rock climbing, trail running, and CrossFit. Participation in these sports can be all-encompassing, transgressing the boundaries of the sport itself and having implications in the broader context of participants' lives. Studies of exercise addiction often focus on lifestyle sports (e.g., running, bodybuilding), portraying some individuals' high levels of involvement as pathological behavior. However, the components of exercise addiction intersect the experiences of competitive athletes and others for whom sport and lifestyle are inseparable, confounding the issue of addiction. The present study aimed to bring the voices of lifestyle sports participants into the discourse that encompasses sport and addiction through exploring their lived experiences. The concept of Foucault's heterotopia was introduced as a lens through which lifestyle choices predicated on sport participation could be objectively understood. In-depth semi-structured interviews of 120 minutes each were conducted with 10 individuals ranging in age from 30-74 years who identified their primary sport as ultradistance running ($n = 4$), adventure racing ($n = 3$), or triathlon ($n = 3$). Consensual Qualitative Research methodology guided the data analysis. Participants discussed their preferences for lifestyle sports over traditional sports and described having concurrent positive and negative experiences at the polar extremes. Positive experiences included feeling accepted in their sport community, overcoming one's limits, and exploring new places. Some participants experienced sport-related interpersonal issues, anxiety, and suicidal ideations. This study illustrated the duality of experiences in lifestyle sports. The lens of heterotopias provided a template for differentiating deliberate choices from addictive behavior in the context of immersive sport involvement, raising questions about the application of exercise addiction in lifestyle sports.

Perceptions of ParticipACTION Among People With Disabilities: An Application of the Brand Equity Framework

Katerina Disimino, York University; Rebecca L. Bassett-Gunter, York University; Leigh M. Vanderloo, ParticipACTION; Amy E. Latimer-Cheung, Queen's University

The well-established benefits of physical activity (PA) may be particularly important for people with disabilities (PWD). However, PA

participation levels among PWD are alarmingly low. Although many Canadian organizations disseminate PA promotion messages through mass media campaigns, these initiatives often neglect the needs of PWD. ParticipACTION is Canada's leading PA promotion brand, and this organization has identified enhanced inclusion for PWD as an important priority. To support PA engagement among PWD, ParticipACTION is undertaking projects that will evaluate the inclusivity of their PA promotion practices. This study applied the brand equity framework to evaluate perceptions of ParticipACTION's branding among PWD. The effects of age on brand perceptions were also explored. Four national online brand surveys were conducted among Canadian adults ($N = 15{,}682$) from July 2019 to November 2020. Survey data were analyzed using logistic regressions and ANOVAs to compare core brand measurements (i.e., impressions, familiarity, relevance, and effectiveness) between people with a physical, sensory, or processing disability and people without a disability, as well as between different age groups. Results from the Campaign Survey indicated that impressions of ParticipACTION were greater among respondents without a disability compared PWD ($d_{\text{physical disability}} = 0.126$; $d_{\text{sensory disability}} = 0.163$; $d_{\text{processing disability}} = 0.155$). Familiarity ($d = 0.224$) with ParticipACTION was greater among respondents aged 45 and older, whereas perceptions regarding relevance ($d = 0.184$) and effectiveness ($d = 0.249$) of ParticipACTION were greater among respondents aged under 45. This study will contribute to the establishment of inclusive PA promotion messaging practices at ParticipACTION. Findings will inform branding and campaign development within ParticipACTION and other PA organizations, ultimately aiming to enhance PA engagement among PWD. Future research will re-evaluate perceptions of ParticipACTION's branding upon implementation of more inclusive PA promotion practices. Funding source: Social Sciences and Humanities Research Council of Canada, Mitacs, and ParticipACTION.

We Know What We Know, But From Whom Did We Learn It? A Historical Summary of Participants Across the Sport and Exercise Psychology Literature

Travis Dorsch, Utah State University; Jordan Blazo, Louisiana Tech University; Anthony Delli Paoli, Rutgers University

The selection of research participants plays a large role in the generation and interpretation of scientific knowledge. In the social sciences, participant selection is often guided by accessibility to human participants. This has led to what some have termed the "WEIRD" phenomenon (Henrich, 2020) – or the overrepresentation of western and educated individuals from industrialized, rich, and democratic backgrounds. The purpose of the present study was to provide a historical accounting of participant selection in the sport and exercise psychology sub-discipline of kinesiology. To address this purpose, we conducted a historical sociodemographic summary of participants across 12 leading journals in the field. These journals were founded between 1930 (*Research Quarterly for Exercise and Sport*) and 2017 (*Case Studies in Sport and Exercise Psychology*), with seven having been founded since the year 2000. The 12 outlets publish empirical, review, methodological, theoretical, and conceptual articles, with a focus on the advancement of theoretically-informed scholarship in sport and exercise settings. More than 14,000 articles have been published across these outlets since 1930, utilizing more than two million human participants. Findings suggest that roughly 80% of the total articles utilized human participants in knowledge generation, the majority of them being White, typically developing males from relatively affluent, educated, Western countries. The use of a historical sociodemographic summary in the present study provides a descriptive overview of participant selection practices across the sport and exercise psychology sub-discipline of kinesiology. In aggregate, data suggest that empirical understanding of human experiences and outcomes in sport and exercise psychology contexts is built from biased sampling of participants. This study therefore illuminates potential knowledge gaps that may have resulted from an apparent lack of diversity across sampled populations as well as potential paths forward for contemporary scholars who choose to address these gaps. Funding source: N/A.

Physical Activity and Facial Affect Recognition in Older Adults Versus Younger Adults

Samantha DuBois, University of North Carolina at Greensboro; Jennifer Etnier, University of North Carolina at Greensboro

Social interactions are a fundamental part of daily life that require individuals to quickly and accurately recognize various social cues, including facial expressions of emotion. With increasing age, facial affect recognition (FAR) abilities decline. Since FAR deficits are associated with loneliness and social isolation, finding ways to preserve the FAR abilities of older adults has important implications for their health and quality of life. In the current study we investigated the relationship between physical activity (PA) level and FAR in cognitively normal younger ($n = 32$, $M_{age} = 23.3 \pm 3.7$ years) and older ($n = 35$, $M_{age} = 74.5 \pm 11.1$ years) adults. Self-reported PA behavior from the Global Physical Activity Questionnaire was used to quantify each participant's metabolic equivalent minutes of PA per week. FAR accuracy and response time were measured with a computerized forced choice recognition task comprised of facial stimuli from the FACES database. These facial stimuli were photos of younger and older adults displaying various emotions. During the task, participants identified the emotion (anger, disgust, fear, happy, or sad) displayed by each facial stimulus. Hierarchical multiple regressions examined if age group, PA level, and the interaction of age group and PA level predicted FAR performance. For FAR response time, the overall model including all predictors was significant ($F(3,63) = 23.15$, $p < 0.01$, $R^2 = 0.52$). Age group ($\beta = 0.85$, $p < 0.01$) significantly predicted response time but this was superseded by a significant interaction of age group by PA level ($\beta = -0.36$, $p < 0.01$), whereby higher PA level was associated with faster response time only for the older adult group. None of the predictors were associated with FAR accuracy. Since difficulties with quickly identifying emotional facial expressions can negatively impact social functioning, these results suggest that participation in PA may mitigate normal age-related declines in FAR. Future experimental research investigating if PA can improve the FAR abilities of older adults is warranted.

Empowering/Disempowering Climates, Motivation and Affective and Behavioural Outcomes in Participation and Performance Level Archers

Joan L Duda, University of Birmingham; Paul Appleton, Manchester Metropolitan University; Juliette Stebbings, University of Portsmouth; Hannah Bussey, Archery GB

Grounded in the theoretically integrated conceptualisation of the motivational climate and its consequences (Duda, 2013), the present study examined the interplay between and tested invariance in hypothesized relationships between perceptions of the empowering/disempowering features of the motivation climate, motivation (autonomous, controlled), and well being and behavioural outcomes (subjective vitality, positive/negative affect, enjoyment, desire to continue) in the case of participation and performance level archers. Online questionnaires (using validated scales) were administered to 434 archers (M age = 51 years; 72% females; 95% White British). 57% of the sample participated in archery recreationally at the club level (participation) with the remainder of the sample being competitive and/or expert archers (performance). Follow-up analyses revealed that participation

archers reported significantly lower empowering climate scores ($M = 4.3$), autonomous motivation ($M = 4.0$), controlled motivation ($M = 1.8$), and positive affect ($M = 3.9$) compared to performance archers ($M = 4.5$, 4.2, 2.3, 4.1, respectively). A model was supported for both groups where perceived empowering motivational climates positively and perceived disempowering climates negatively predicted autonomous motivation. Autonomous motivation scores positively linked to enjoyment, positive affect, subjective vitality and intentions to continue in both groups of archers. The present findings point to the importance of promoting more empowering motivational climates (and less disempowering climates) at both the recreational and more elite levels of sport.

A Mixed-Methods Evaluation of True Champion: A Videogame Intervention for the Primary Prevention of Supplement Abuse and Doping in Adolescent Athletes

Lindsay Duncan, McGill University; Evelyne Bedard, McGill University; Loana Gheta, McGill University; Jeffrey Caron, University of Montreal

True Champion is an educational videogame developed by this research team as an intervention for the primary prevention of doping and supplement abuse among athletes aged 13 to 16 years. In the game, players help an athlete character navigate through a sport season, balancing key stats (i.e., performance, health, social, leadership, and resilience), and facing a variety of scenarios that may support their development and/or put them at risk of doping. The purpose of this study was to evaluate how adolescent athletes learned about doping prevention through playing *True Champion*. Thirty-eight adolescent athletes ($M_{age} = 14.5$, $SD = 1.10$; 50% female) from a variety of sports played *True Champion* once ($n = 18$) or five times ($n = 20$) on their own and then participated in an online one-on-one session where they played the game from start to finish (with screen sharing and recording) and then discussed the game in a semi-structured conversation with a research assistant. Gameplay data that track the players' decisions and scores were recorded during each gameplay session. A qualitative, directed content analysis was conducted to explore players learning of the key curricular content from the game and their connections of game content to real life. Gameplay data were used to characterize the challenges, accomplishments, and improvements of players during their gameplay sessions. Findings from the qualitative and quantitative data showed that athletes learned (a) key anti-doping rules, (b) that performance and health are high priority for athletic success, but athletes must also be mindful of many other factors, (c) the people athletes surround themselves with are important and influential for success but can also put athletes at risk of doping, (d) "coming back" after making an ethical mistake takes focused work on resilience and knowledge of anti-doping rules. *True Champion* is a novel approach to engaging young athletes in doping prevention education that appears to be successful for instilling key lesson to help adolescents avoid the risk of doping and supplement abuse. Funding source: International Olympic Committee.

Perceptual-Cognitive Training of Youth Soccer Players in a 360°-Environment: An Investigation of the Effects on Soccer-Specific Performance

Paul Ehmann, Goethe University; Adam Beavan, TSG ResearchLab gGmbH, Germany; Stefan Altmann, TSG ResearchLab gGmbH, Germany; Ludwig Ruf, TSG ResearchLab gGmbH, Germany; Jan Spielmann, TSG ResearchLab gGmbH, Germany; Jan Mayer, TSG ResearchLab gGmbH, Germany; Christian Nuß, Goethe University; Niklas Klever, Saarland University; Sonja Rohrmann, Goethe University; Chris Englert, Goethe University

Numerous studies highlight the importance of perceptual-cognitive skills for sports performance. Moreover, in team sports like soccer, the effects of isolated perceptual-cognitive training on sports performance have been investigated in the past. Mixed findings and limitations in previous research call for further investigation. In this context, the current study pursued several objectives: First, the relationship between perceptual-cognitive performance in a dynamic 360° environment and soccer-specific performance was examined. Second, the effects of perceptual-cognitive training in such an environment on soccer-specific performance were investigated. 42 youth soccer players aged between 11 – 13 years were tested at T1 regarding their perceptual-cognitive performance using a 360°-multiple object tracking task (360-MOT). Soccer-specific performance was assessed using an isolated passing task and a small-sided game. The participants were then randomly assigned to a perceptual-cognitive training group, an active control group, or a non-treatment control group. The training group completed a 20-minute 360-MOT training session twice a week over a 5-week period, while the active control group received a pseudo video training. Perceptual-cognitive and soccer-specific performance were assessed again at T2 following the training phase. At T1, there was a significant positive relationship between 360-MOT performance and the accuracy score in the passing task ($r = .31$, $p = .045$) and defensive performance in the small-sided game ($r = .35$, $p = .031$). Analysis at T2 revealed a significant task-specific training effect from T1 to T2 only for the 360-MOT training group, $t(13) = 9.51$, $p < .001$, $d = 2.5$. However, there was no transfer effect of perceptual-cognitive training on soccer performance. The results indicate the relevance of perceptual-cognitive performance in a 360° environment for soccer performance on the one hand but question the effectiveness of brief isolated perceptual-cognitive training interventions on the other hand.

Online Learning Modules for Para-Athletes: Increasing Their Use of Psychological Skills

Frank O. Ely, University of Windsor; Krista J. Munroe-Chandler, University of Windsor; Todd M. Loughead, University of Windsor; Jeffrey J. Martin, Wayne State University

While descriptive research exploring para-athletes' use of psychological skills has received notable attention (Esatbeyoglu & Campbell, 2018; Martin, 2005), longitudinal intervention research in the area is rare (Martin, 2019). Further, many para-athletes have limited access to psychological skills training (PST) (Dieffenbach & Statler, 2012). One potential method towards improving such access is through an online PST program, however, little is known regarding the effectiveness of such an approach (Munroe-Chandler & Guerrero, 2019). Thus, the purpose of the current study was to determine if a longitudinal online PST program could increase para-athletes' use of psychological skills. This free program (learnpst.com) consists of eight interactive, asynchronous, online learning modules. Each module presents a unique psychological skill and is administered once a month for eight consecutive months. Participants' use of psychological skills is assessed at three time points (pre-, mid-, and post-intervention) using a modified version of the Test of Performance Strategies-2 questionnaire for practice and competition (Hardy et al., 2010). Although data collection is ongoing, findings from those who have completed the first four modules (goal setting, imagery, self-talk, and routines) will be presented here (i.e., pre- and mid-intervention). Results indicated that participants ($N = 11$; $M_{age} = 32.72$ years, $SD = 12.32$) increased their use of all four psychological skills in both practice and competition. For practice, statistically significant changes were found in goal setting ($p = .03$; $d = 0.62$), imagery ($p = .02$, $d = 0.64$), and self-talk ($p = .04$; $d = 0.66$). In competition, however, significant changes were seen in imagery ($p = .03$, $d = 0.64$), self-talk ($p = .01$, $d = 0.85$), and routines ($p = .01$, $d = 0.93$). These findings provide preliminary evidence that an online PST intervention can increase para-athletes' use of psychological skills in both practice and

competition. Thus, an online program could serve as an accessible option for para-athletes to pursue PST. Funding source: SSHRC.

The Association Between Physical Activity and Substance use Among Canadian Youth: Exploring the Moderating Role of School Connectedness

Matthew James Fagan, University of British Columbia; Markus Joseph Duncan, Brock University; Robinder Bedi, University of British Columbia; Eli Puterman, University of British Columbia; Scott Leatherdale, University of Waterloo; Guy Faulkner, University of British Columbia

Physical activity may play a role in promoting or preventing current substance use among youth. The purpose of this study was to examine the association between different types of physical activity (i.e., non-competitive school sport, competitive school sport, outside of school sport and minutes of moderate to vigorous physical activity (MVPA) per day) and substance use (i.e., current smoking, e-cigarette, cannabis, binge drinking status) among Canadian adolescents. Interaction effects between physical activities and school connectedness were also examined. Using data from the COMPASS study (2017–18; n = 59435) four multi-level logistic regression models were developed to investigate whether physical activity lessened or worsened the odds of substance use; 1) smoking; 2) e-cigarette use; 3) cannabis use; and 4) binge drinking. Models were adjusted for demographic factors and other covariates. Sport participation was consistently associated with substance use, whereas less evidence was found for meeting MVPA guidelines. Non-competitive school sport lessened the odds of cannabis use for boys and girls. However, non-competitive school sport only lessened the odds of e-cigarette use for girls but increased the odds of binge drinking for boys. Participation in competitive school sport lessened the odds of cigarette smoking but increased the odds of e-cigarette use and binge drinking for boys and girls. Outside of school sport lessened the odds of cigarette smoking and cannabis use but increased the odds of e-cigarette use and binge drinking for boys and girls. A significant moderation effect was found for boys participating in sport outside of school and meeting MVPA guidelines who were at a lower risk of e-cigarette use in the presence of high levels of school connectedness. Our study provides evidence for further consideration and provision of extracurricular activities, specifically non-competitive sport, in protecting against substance use. Caution is required in claiming that sport participation or physical activity, in general, is protective against substance use. Funding source: CIHR studentship.

Exploring the Relationship Between Health-Related Fitness Knowledge and Physical Activity Behaviors of Students in Secondary Physical Education

Rick Ferkel, Central Michigan University; Kevin Fisher, Central Michigan University

The need for fitness enhancement competence in adolescents to drive autonomy for lifetime physical activity (PA) is an important element for health and fitness professionals to consider. One component that can increase competence is health-related fitness knowledge (HRFK). Research has indicated HRFK as a determinant of PA, but overall knowledge has been low amongst all age groups. The purpose of this study was to examine the relationship between HRFK and PA behaviors in middle school and high school students. Students in grades 7-12 ($N = 729$, $M_{grade} = 9.65$) in a Midwest public school district completed the following measures: 1.) health-related fitness knowledge test (FitSmart Test, Zhu et al., 1999), 2.) cardiovascular exercise habits (CEH) and muscle strengthening exercise habits (MSEH) questionnaire, and 3.) self-report PA used to calculate METs (Leisure Time Exercise Questionnaire, Godin and Shepherd, 1985). Statistical analysis via hierarchical regressions indicated a small but significant relationship between HRFK and the following variables: METs, $R^2 = .005$, $p = .05$; CEH, $R^2 = .006$, $p < .05$; and MSEH, $R^2 = .016$, $p < .001$. HRFK was positively correlated with CEH ($r = .079$, $p < .05$) and MSEH ($r = .133$, $p < .01$), and negatively correlated with METs ($r = -.093$, $p < .05$). HRFK was also positively correlated with student grade level ($r = .391$, $p < .01$), but scores were low overall ($M = 60.4\%$, $SD = 20.3\%$). These results suggest that HRFK plays a limited role in adolescent PA behaviors. An issue that continues to arise within research investigating HRFK is low assessment scores, which inhibits delineation between HRFK levels and possible differences in PA behavior. Future research is needed to explore interventions that increase HRFK and changes in PA behavior among adolescents. Funding source: Central Michigan University Office of Research and Graduate Studies.

Validation of the CRAVE/ARGE Scale in Brazilian Portuguese: A Motivation States Study

Alberto Filgueiras, Rio de Janeiro State University; Matthew Stults-Kolehmainen, Yale – New Haven Hospital; Fabio Amador Bueno, Gateway Community College; Artur Viana, Yale University Medical School; Andre Ricarte Medeiros, Federal District Secretary of Education (SEEDF); Miguel Blacutt, Teachers College – Columbia University; Daniel Boullosa, Federal University of Mato Grosso do Sul; Garrett Ash, Veterans Affairs Connecticut Healthcare System

According to the WANT model (Stults-Kolehmainen et al., 2020), motivation for movement and rest varies moment to moment. To assess these motivation states, the CRAVE scale (Cravings for Rest and Volitional Energy Expenditure) was recently developed. The purpose of the current study is to validate the scale in Brazilian Portuguese. The scale and instructions were translated from English to Brazilian Portuguese by the first author, with inspection and refinement independently conducted by 5 native speakers (authors FAB, AV, ARM along with AT and KC). Additional modifications were made for clarity, precision, simplicity, and alignment with the WANT model. Instructions were amended to reflect states (e.g., estar, ficar) and not traits (e.g., ser). The new scale was then back translated by the first author. The original, translated and back translated versions were sent to three bilingual referees for content validation. Content validity coefficients (CVC) across 3 dimensions, calculated according to the algorithm developed by Filgueiras (2015), were excellent (.89-.91). The translated scale was named Anseios por Repouso e Gastos com Energia (ARGE). 1,168 participants (mean age = 30.6, $SD = 12.2$; 71.6% female) from across Brazil completed an online version of the ARGE. The sample was split in half for Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Cronbach Alphas for Move and Rest subscales were excellent (.93 and .91). MOVE and REST factors were moderately correlated (-.60 to -.62). The EFA found two, very clear oblique factors (Move and Rest) with good reliability (.92 and .94). The GFI was 1.00 and RMSR was .03. The CFA model was very good, with NFI and CFI both .99; GFI = .96; RMSEA = .057 and SRMR = .033. Therefore, the ARGE, the translated version of the CRAVE scale, appears to have excellent psychometric properties and is valid in Brazilian Portuguese. Special thanks to: Alexandra Turner, Khristdman Cavalcanti, Bruno Galvão, Pedro Pires and Rodrigo Pieri.

Comparison of 10- and 13-Item Versions of the CRAVE/ARGE Scale in a Large Sample of Brazilians: A Motivation States Study

Alberto Filgueiras, Rio de Janeiro State University; Matthew Stults-Kolehmainen, Yale – New Haven Hospital; Fabio Amador Bueno, Gateway Community College; Artur Viana, Yale University Medical School;

Andre Ricarte Medeiros, Federal District Secretary of Education (SEEDF); Miguel Blacutt, Teachers College – Columbia University; Daniel Boullosa, Federal University of Mato Grosso do Sul; Garrett Ash, Veterans Affairs Connecticut Healthcare System

The CRAVE scale (Stults-Kolehmainen et al., 2021) was developed to measure affectively-charged motivation states (ACMS) as conceptualized by the WANT model (Stults-Kolehmainen et al., 2020). This scale has 13 items, 10 of which are scored (5 each for move and rest subscales), while 3 are fillers. Some evidence exists (Stults-Kolehmainen et al., 2021), however, that the scale has better psychometric properties when scored with all 13 items (6 for move and 7 for rest). The scale has been recently translated into Brazilian Portuguese (the ARGE scale) and shows excellent psychometric properties. The purpose of this study is to analyze the same dataset with additional models to determine if the 10-item scale exhibits advantages over the 13-item scale. Three models were tested: Model 1: all 13 items; Model 2 (new version): 10 items with 3 items cross-loading; Model 3: 10 items without extra cross-loading. All fit indexes were above .95; all error indexes below .05; no difference above .05 when models were compared. Examining the parsimony indexes, the old model (Model 1) has a marginal difference in its favor: .77 and .64 against .75 and .60 from the new model (Model 2). However, examining AIC and CAIC, the new model (Model 2) has a better solution than the old model (Model 1) (124×237). The new model (Model 2) has fewer items; therefore it is slightly better as it avoids error covariance. A larger issue is that in the new model (Model 3), correlation between factors increases to -.71, which would be a high negative correlation, a cut-off usually considered undesirable. The 10- and 13-items versions of the ARGE had nearly identical correlations between MOVE, REST, state anxiety, and moderate and strenuous physical activity. The new model (Model 2) fits well, and the difference between models was less than 0.05. Therefore, one cannot discard the new model for these data. However, because the original validation publication used the 10-item version, it seems reasonable to adopt it for further analyses, as it was the final version of the English scale. Funding source: None.

Does Perfectionism Predict Sport Performance?

Daniel J. M. Fleming, Utah State University; Luke F. Olsson, University of Essex; Sarah H. Mallinson-Howard, York St John University; Travis E. Dorsch, Utah State University

Research has sought to determine if the two higher-order dimensions of perfectionism (perfectionistic strivings and perfectionistic concerns) are beneficial to or hinder sport performance. Evidence suggests that perfectionistic strivings are often related to better sport performance, whereas perfectionistic concerns is typically unrelated to sport performance (see Hill et al., 2018). However, such research has largely examined sport performance by proxies of training or laboratory and field-based tests. The present study builds on previous research by examining if the two higher-order dimensions of perfectionism predict i) competition performance in golf and ii) if these relationships exist after controlling for golfers' current skill level (handicap). Participants were 102 male adult golfers (M_{age} = 28.3 years, SD = 11.6 years, $M_{handicap}$ = 0.98, SD = 2.13) competing at a regional level competition in England. Perfectionistic strivings and perfectionistic concerns were measured prior to the competition using the Multidimensional Inventory of Perfectionism in Sport (MIPS, Stoeber et al., 2006). Competition performance was measured using golfers' total round score relative to the course par. Multiple regression analysis showed that perfectionistic strivings predicted better performance (B = 0.92, p = .03), while perfectionistic concerns were a non-significant predictor of performance (B = -0.13, p = .80). However, when round score was adjusted for by player handicap, neither perfectionistic strivings (B = -0.56, p = .17) nor perfectionistic concerns (B = -0.09, p = 0.85) significantly predicted performance. Findings from the present study suggest that once skill level is accounted for perfectionistic strivings may not be beneficial for sport performance. Replicating these findings in other sports would help further understanding of this relationship.

Preliminary Outcomes of an Online Resistance Exercise Pilot Study Among Racially Diverse Breast Cancer Survivors

Angela J. Fong, Rutgers Cancer Institute of New Jersey; Shawna V. Hudson, Rutgers Cancer Institute of New Jersey; Kathryn Schmitz, PennState Cancer Institute; Sharon L. Manne, Rutgers Cancer Institute of New Jersey

Background: Breast cancer survivors face salient barriers related to physical activity including lack of access to programs and loss of muscular strength following active primary treatment. Evidence-based online-delivered physical activity interventions attenuate access-related barriers and breast cancer survivors reported feeling motivated to enroll in such interventions. Once enrolled, participants report high satisfaction for online-delivered intervention. Similarly, loss of muscular strength can interfere with increasing physical activity levels, yet few interventions focus on resistance exercise. Further, few physical activity interventions include a racially diverse sample and findings may not be generalizable. The aim of the current pilot study is to determine preliminary feasibility, acceptability, and satisfaction of the Breast cancer and Resistance Exercise Program (B-REP) among participants who have completed the study. Methods: B-REP is an on-going 12-week, 2-arm randomized controlled trial with weekly, one-on-one supervised resistance exercise sessions delivered over Zoom for the intervention arm and with a printed exercise program for the control arm. Data collection methods included questionnaires at baseline and post-intervention and attendance tracked by research staff throughout the study. Results: Among enrolled participants (N = 37; Mage = 53.9, SD = 12.8), almost half (47.2%) self-identified as non-White (Black = 27.8%, Asian = 14%, Latina/Hispanic = 5.6%) and were not sufficiently active (leisure score index M = 15.9, SD = 15.5). Among participants who completed the study (n = 24; 16 intervention and 12 control), participant retention was 93.8% for intervention arm and 66.6% for control arm and session attendance was 100%. The acceptance rate was 66.1%. B-REP was rated as 'quite satisfactory' (M = 4.9 out 5, SD = .18). Discussion: B-REP shows promising feasibility and acceptability outcomes among a sample of racially diverse breast cancer survivors. Future directions include determining efficacy for muscular strength, physical function, and self-efficacy. Funding source: Rutgers Cancer Institute and RWJ Barnabas Health Mission Support.

That was Clutch! Clutch Performance in eSports & Competitive Video Games

Axel Franco, California State University, Northridge; Christian Garcia, California State University, Northridge; Mark Otten, California State University, Northridge; Omar Ruvalcaba, California State University, Northridge

In the domain of traditional sports, a clutch play can be defined as any performance increment that occurs under pressure circumstances (Otten, 2009). Situations that demand enhanced performance typically occur in make-or-break situations such as a buzzer beater basketball shot or a 9th inning home run. High pressure situations in sports are not uncommon, but what about eSports? eSports has seen a staggering increase in popularity with the advent of video streaming platforms. eSports can be broadly defined as the competitive play of video games in public settings such as online settings or through streaming platforms (Ruvalcaba et al., 2018). Despite push back on its legitimacy as a sport, eSports and eSports athletes have seen an increase in acceptance. There are many similarities that are

shared between traditional sports and eSports such as: training sessions, fans, and tournaments. Further, eSports can be played at a professional level much like other sports. At this level it is also not uncommon to see athletes exhibit clutch performances. Unlike traditional sports, it is not known what aspects in competitive video gaming induce clutch performance. We sought to explore the different aspects of a popular battle royal first-person shooter game (FPS) to understand the indices of clutch performances in competitive video gaming. Publicly available video clips of clutch performances were gathered by two independent graduate students from online streaming platforms. From this information, consensus was reached on different factors that may influence the occurrence of clutch performance. This information was used to create a scale of clutch performance that will be useful in the field of eSports research. The scale was furthermore implemented to determine a spectrum of clutch performances from players within the videogame Apex Legends to provide concrete examples within a competitive FPS.

How do Elite Baseball Batters Perceive a "Rising" Fast Ball?

Takehiro Fukuda, Kashino Diverse Brain Research Laboratory, NTT Communication Science Laboratories; Aina Endo, Interactive Media Lab, Graduate School of Science and Technology, Keio University; Maki Sugimoto, Interactive Media Lab, Graduate School of Science and Technology, Keio University; Toshitaka Kimura, Kashino Diverse Brain Research Laboratory, NTT Communication Science Laboratories

Batters sometimes feel that fastballs rise or hop suddenly as they approach the home plate. What factors determine this perception? It is conceivable that some physical parameters of the pitched ball, such as ball spin rate and axis, generate the rising perception, because it is known that an increase in these parameters can enlarge the batter's missed swing rate. We propose that the pitching motion-related information also cause the "rising" ball effect, since it is considered that the batters watch pitching motion to predict the pitched ball behavior in order to compensate for the severe time constraint. However, it is unclear how pitching motion impacts perception of the pitched ball. We performed two experiments to clarify which characteristics of pitching motion impact the rising perception of fastballs in elite baseball players using a head-mounted display, based virtual reality (VR) system for baseball batting. In advance, the physical characteristics of 8 elite pitcher's motions and their pitched balls were measured by the Trackman and the Optitrack systems, respectively to provide participants with realistic pitching motion and ball behavior stimuli in the VR system. In Experiment 1, 30 baseball players participated to subjectively evaluate the intensity of rising perception for 8 pitchers. We found a significant positive correlation between the rising perception intensity and the pitching motion duration. Due to this result, in Experiment 2, we manipulated the pitching motion duration (0.8x and 1.2x) with fixed ball behavior for a single pitcher in the VR system. The participants evaluated the rising perception through a two-alternative forced choice paradigm. There were significant differences among distinct conditions for pitching motion duration, indicating that the players evaluated the ball trajectories created faster pitching motion as rising. These results suggest that the batters estimate the error between predicted and actual ball behavior and this prediction error generates "rising" feeling for pitched balls.

Navigating a New Normal: Perceptions and Experiences of Online Exercise Programming for Older Adults During COVID-19

Sarah Galway, Brock University; Matthieu Dagenais, Brock University; Kimberley Gammage, Brock University

Online exercise programming has surged in popularity, particularly during the COVID-19 pandemic; however, little is known about older adults' perceptions and experiences of online exercise programming. The purpose of the present study was to qualitatively examine older adults (aged 59-82) perceptions and experiences of online exercise programming during the closure of face-to-face programming during the COVID-19 pandemic. Nineteen older adults (7 males, 12 females) from an exercise facility in Southern Ontario participated in a one-on-one interview via video-conferencing software or telephone. Participants included both individuals who engaged in the online programming and those who did not. A semi-structured interview guide was used to facilitate conversations; interview questions were designed to generate conversations about the participants' initial and current perceptions of the online programming, their experiences exercising during COVID-19, and advantages and barriers of online exercise programming. Data were analyzed using reflexive thematic analysis. Participants discussed a variety of advantages and disadvantages of online exercise programming, with three themes generated, including: (1) can online exercise really work? (2), technology attitudes shape exercise perceptions and (3) home sweet home?: advantages and shortcomings of shifting to online exercise programming. Overall, most participants enjoyed the online exercise programming and were able overcome initial barriers through technical support and positive experiences. Social experiences were fostered through effective leadership by instructors, although the online format made them more difficult. Our findings highlight the importance of adequately training exercise instructors to teach online specifically. Although online exercise programming could not entirely replace face-to-face programming, a hybrid combination of online and face-to-face programming may encourage regular participation in physical activity and exercise and should be further explored.

The Effects of Active Upper-Limb Versus Passive Lower-Limb Exercise on Quality of Life Among Individuals With Motor-Complete Spinal Cord Injury

Cameron Marshall Gee, University of British Columbia; Adrienne Sinden, University of British Columbia; Andrei Krassioukov, University of British Columbia; Kathleen Martin Ginis, University of British Columbia

The cardiometabolic benefits of exercise for people with spinal cord injury (SCI) are well established. In contrast, and despite the dramatic life impact of SCI, relatively few studies have examined the quality of life (QOL) benefits of exercise and of different exercise modalities. The purpose of the present study was to (1) compare the effects of active upper-limb exercise (arm-cycle ergometry (ACET)) and passive lower-limb exercise (body weight supported treadmill training (BWSTT)) on QOL and psychosocial mediators in individuals with SCI; (2) examine correlations between baseline measures, and changes in physical activity, QOL, and psychosocial mediators. Participants with motor-complete SCI above T6 were recruited from two hospital-based research institutes and one University-based exercise program. Participants completed baseline assessments of physical activity, life satisfaction, independence, autonomy, positive and negative affect, and pain. Participants ($n = 28$) were randomized to 72 sessions of ACET ($n = 14$) or BWSTT ($n = 14$) with measures repeated following 36 sessions, 72 sessions, and 6-months post-intervention.Neither intervention significantly impacted QOL. Pain was reduced in ACET compared to BWSTT (group×time $p = .022$) and was significantly less at 72 sessions vs. baseline in the ACET group ($p = 0.009$). At baseline, QOL positively correlated with independence, autonomy, and positive affect and negatively correlated with negative affect (all $p < .05$). Following BWSTT, changes in moderate-vigorous physical activity correlated with changes in QOL ($r = .87$, $p = .010$). Following ACET, changes in autonomy and independence positively correlated with changes in QOL (both $r > .64$, $p < .048$). Despite the fitness benefits of ACET, there was no benefit of either intervention on measures of QOL. This may be a reflection of the clinical environment in

which the intervention took place. However, individuals may benefit more from active (ACET) than passive (BWSTT) exercise modalities through reduced pain. Funding source: Canadian Institutes of Health Research (TCA 118348); Social Sciences and Humanities Research Council of Canada (grant no. 895-2013-1021).

Perceived Fitness, Grip Strength, Post-Traumatic Stress Disorder Symptoms, Mental Health and Cardiovascular Risk in Refugee Camp Residents

Markus Gerber, University of Basel; Konstantinia Filippou, University of Thessaly; Florian Knapp, University of Basel; Elsa Havas, University of Thessaly; Ioannis D. Morres, University of Thessaly; Antonis Hatzigeorgiadis, University of Thessaly

Due to ongoing conflicts, the number of international refugees is increasing. Refugees are often exposed to traumatic experiences before, during and after their flight. Therefore, they are a particularly vulnerable population, with a high risk of post-traumatic stress disorders (PTSD), other mental illnesses and cardiovascular diseases. The United High Commissioner for Refugees (UNHCR) recognizes the potential of exercise and sport and uses it in refugee camps partly as a peace-building measure. Therefore, a 10-week exercise and sport intervention (SALEEM) was designed for refugees living in a Greek refugee camp. In total, 98 participants (41 men, 57 women) were recruited and randomly assigned to an intervention or waiting-list control group. Here, we present data from the baseline data assessment to examine whether and to what degree perceived fitness and grip strength were associated with several health outcomes, including post-traumatic stress disorder symptoms, mental health and cardiovascular risk markers (blood pressure, blood glucose, blood lipids, C-reactive protein, percentage body fat). The findings show that using the 22-item Impact of Event Scale-Revised (IES-R), 60% of the sample reported clinically relevant PTSD symptoms. Partial correlations (adjusted for sex and body mass index) showed that perceived fitness was negatively associated with PTSD symptoms, depressive, anxiety and insomnia symptoms, and pain, whereas a positive association occurred for quality of life. Grip strength was not correlated with any of these measures; however, higher grip strength was associated with higher muscle mass and lower body fat. Neither perceived fitness nor grip strength were associated with any of the cardiovascular risk markers. The present findings suggest that perceived fitness constitutes a relevant health resource in international refugees that is closely linked to their mental wellbeing. Therefore, increasing self-perceived fitness constitutes an important target variable for exercise and health interventions in this setting. Funding source: Swiss Network for International Studies (SNIS).

Do High Levels of Cardiorespiratory Fitness Mitigate the Cardiovascular Risk of in-Patients With Major Depressive Disorders and Healthy Controls?

Markus Gerber, University of Basel; Jan-Niklas Kreppke, University of Basel; Robyn Cody, University of Basel; Johannes Beck, Psychiatric Clinic Sonnenhalde; Anne Eckert, University of Basel; Martin Hatzinger, Psychiatric Services Solothurn; Christian Imboden, Private Clinic Wyss; Undine Lang, University of Basel; Sarah Mans, Private Clinic Wyss; Thorsten Mikoteit, Psychiatric Services Solothurn; Ann-Katrin Schreiner, Psychiatric Clinic Sonnenhalde; Nina Schweinfurth, University of Basel; Serge Brand, University of Basel; Lukas Zahner, University of Basel; Oliver Faude, University of Basel

Major depressive disorder (MDD) is a widespread disorder and among the leading causes of disability worldwide. Depression is accompanied by biological and behavioral features that may be harmful to physical health. Nevertheless, studies in which researchers investigated whether cardiorespiratory fitness [CRF] can mitigate some of the cardiovascular health risks associated with depression are still scarce. In this paper, we present preliminary data from the baseline data assessment of the "Physical Activity Counseling in In-Patients with MDD" (PACINPAT) study, a multi-centric two-arm randomized clinical trial including an intervention and placebo control group, with women and men aged 18-65 years. To be included, in-patients had to have scores on the Beck Depression Inventory (BDI) of ≥ 17, and moderate-to-vigorous physical activity of ≤ 150 min/week. A healthy control group was recruited (BDI ≤ 13, MVPA ≤ 150min/week). All participants ($N = 284$) performed a submaximal fitness test (Åstrand-Rhyming) to estimate VO_2max. Two-way ANCOVAs were calculated to compare CVD risk in in-patients and healthy controls, in relation to their CRF levels (using a tertile split). After controlling for age and sex, in-patients had higher waist circumference, BMI, blood glucose (HbA1c), low-density lipoprotein cholesterol (LDL-C), whereas they scored lower on self-perceived fitness and VO_2max ($p < .05$). Participants with lower CRF had higher waist circumference, BMI, percentage body fat, blood pressure (systolic and diastolic), total cholesterol, LDL-C, and triglycerides, whereas they had lower scores on self-perceived fitness ($p < .05$). No significant two-way interactions were found. In conclusion, higher CRF was associated with decreased cardiovascular risk in both healthy controls and in-patients with MDD. Because of the increased CVD risk, improving CRF via physical activity counseling seems particularly useful in in-patients with MDD, but constitutes a particular challenge given the specific motivational features of this target population. Funding source: Swiss National Science Foundation (SNSF).

Affectively-Charged Motivation States to Move, Be Active and Be Sedentary: Mixed-Method Validation and Changes Across a Focus Group Interview Period

Todd A. Gilson, Northern Illinois University; Matthew Stults-Kolehmainen, Yale – New Haven Hospital; Cyrus Dadina, Dobbs Ferry High School (NY); Christopher J. Budnick, Southern Connecticut State University; Daniel Boullosa, Federal University of Mato Grosso do Sul; John B. Bartholomew, The University of Texas at Austin; Fabio Amador Bueno, Gateway Community College; Jessica Barker, Winona State University; Miguel Blacutt, Teachers College – Columbia University; Paul McKee, Duke University; Adrian Haughton, Yale School of Medicine; Garrett Ash, Veterans Affairs Connecticut Healthcare System

According to the WANT model, motivation for physical activity and sedentary behaviors (e.g., desires, urges, wants, and cravings) varies from moment to moment. Previous studies have shown changes with periods of maximal exercise or passive rest. The purpose of this study was to examine tenets of the WANT model from a mixed-method perspective. We also hypothesized that motivation states would change over the course of an interview period. Seventeen undergraduate students (mean age = 18.6, 13 women) engaged in 1 of 7 focus groups where 12 structured questions were presented. Researchers used content analysis to analyze results. Participants completed the "right now" version of the CRAVE scale before and after. Themes largely corroborated tenets of the WANT model, but also presented unique perspectives. Participants stated that they did experience desires to move and rest, including at the time of the interview, but these states can rapidly change or dissipate, and often differed from desires over the past week. They also described a total absence of desire, often during flow states, or even aversion to move and rest. Desires were often consummated with behavior (e.g., working out), which often resulted in satiation – loss of desire. Of note, strong urges and cravings for movement, typically from conditions of deprivation (e.g., sudden decreases in exercise) were associated with physical and mental manifestations, such as leg stiffening,

fidgeting, feelings of being antsy, jittery, and restless. Urges for rest and sleep resulted in differing phenomena. At the end of the interview, 12 participants declared a greater desire to move, 4 greater to rest, and 1 had no perceived changes. 5 expressed greater awareness of desires. CRAVE-Move (right now) significantly changed from 28.9 ($SD = 9.8$) to 35.3 (8.9) ($p < 0.01$). CRAVE-Rest demonstrated a trend to decline: 17.3 ($SD = 10.9$) to 11.9 (8.3) ($p = 0.057$). This is the first mixed-method study to provide evidence that individuals experience wants or desires to move and rest, and that these states appear to be highly volatile. Funding source: None.

The Role of Motivation States in the Regulation of Movement and Sedentarism: Automaticity, Deliberation, Self-Control and "Want-to" Versus "Have-to"

Todd A. Gilson, Northern Illinois University; Matthew Stults-Kolehmainen, Yale – New Haven Hospital; John B. Bartholomew, The University of Texas at Austin; Christopher J. Budnick, Southern Connecticut State University; Fabio Amador Bueno, Gateway Community College; Garrett Ash, Veterans Affairs Connecticut Healthcare System

Motivation states for movement and rest (e.g., desires, urges) are ostensibly antecedents to and consequences of behavior, but how they operate within behavioral systems is unknown. Various models related to dual processes and the Elaborated Process Model provide useful frameworks. The purpose of this work was to qualitatively describe how motivation states influence behavior through automatic and self-regulatory processes. Seventeen undergraduate students (mean age = 18.6, 13 women, 7 non-white) engaged in 1 of 7 focus groups where 12 structured questions were presented. Researchers used content analysis to analyze results. Participants were clear that positive and negative perceptions, physical sensations, such as tiredness, pain and soreness, and a variety of external variables, such as cues, were antecedents of movement and rest. Automatic processes of regulation were most described. Participants widely reported diurnal, weekly and seasonal variation in desires for movement and rest. Themes centered on ideas of inertia (e.g., being "in a rut") and momentum, randomness, and spontaneity. Participants indicated that habit or movement's instrumental value drove their behavior without awareness a desire for movement. Participants also described, though less frequently, deliberative processes, such as decision making, planning, energy management and prioritization of rest and exercise, usually in the context of conflict, which was a major theme. Conflict existed between desires as well as between desires and goals, "want to" and "have to" (should). Resulting behavioral outcomes were often influenced by willpower, self-control, or harmonization. Sometimes desires were manipulated or ignored, but frequently urges and cravings were strong enough to influence or hijack thoughts and attention and could not be overcome, resulting in rapid behavior. On the other hand, there were a variety of barriers blocking consummation of desire, such as injury, exhaustion, and responsibilities. Taken together, motivation states appear to play a prominent role in behavior processes. Funding source: None.

Running Flow: Evaluating of a Flow Intervention for Runners

Scott G. Goddard, Southern Cross University, Australia; Christopher J. Stevens, Southern Cross University, Australia; Christian Swann, Southern Cross University, Australia

Flow is an immersive and effortless psychological state associated with increased performance, wellbeing, and intrinsic rewards, making it highly sought after in sport and exercise. Despite 45 years of research, flow remains rare, elusive, and unpredictable. This study aimed to evaluate the efficacy of a flow intervention for runners using a mixed-method design including a mixed 2 (group) x 2 (run) experimental design supplemented by qualitative data from event-focused interviews. Twenty Australian runners (6 women; 14 men; $M_{age} = 29.65$ years, $SD = 7.95$), ranging from recreational to elite, completed two 20-minute self-paced runs on a treadmill. Participants were randomly assigned to a control ($n = 10$) or intervention group ($n = 10$). All participants completed a 20-minute baseline run (with the goal to "run at a comfortable pace for 20-minutes"). The control group repeated their second run following the same baseline instructions. The intervention group completed their second run following a protocol that incorporated a combination of open goals (i.e., "see how far you can run in 20 minutes"), audible time and performance feedback, and individualised metronome tempo. Measures recorded for each run included flow, distance, perceptions of performance, ratings of perceived exertion, and mental effort. A semi-structured interview ($M = 13{:}25$ minutes) was also conducted with all participants at the end of the session. Quantitative results revealed significant increases in flow across attempts for both control and intervention groups, $F(1, 18) = 16.39$, $p < .001$, $h_p^2 = 0.48$. The integration of quantitative and qualitative data revealed that both flow and clutch states were experienced in each condition. These data also reveal how contextual factors, preceding expectations, and varying interpretations of intervention components may explain why both states were experienced in both runs. Whilst this study successfully induced flow in runners, the findings emphasise important theoretical and methodological considerations for future flow interventions, which will be discussed. Funding source: Australian Government Research Training Program (RTP).

Perceptions of Parent Behavior and Burnout in High School Coaches

Genevieve Gottardo, Michigan State University; Justin Worley, Utah State University; Alan Smith, Utah State University

Because coaching requires continuous interaction with agents such as athletes, parents, and others, the social context of sport is important to consider relative to coaches' motivation. Coach perceptions of parent behavior constitute a prominent yet understudied feature of the social sport environment and have potential to contribute to or mitigate coach burnout. The aim of our study was to examine if coach perceptions of parent behavior were associated with their burnout by way of psychological need satisfaction and thwarting. High school coaches (N =192, Mage= 43.43, SDage = 11.85) completed an online survey assessing autonomy supportive and controlling behaviors from parents, psychological need satisfaction and thwarting, and the burnout dimensions of emotional exhaustion, devaluation, and reduced accomplishment. Controlling parent behavior was not reliably measured ($\alpha = .53$) and was not included in the statistical analyses. Observed variable path analysis showed perceptions of parent autonomy support to be positively associated with coaches' global need satisfaction ($\beta = .47$, $p < .001$) and negatively associated with global need thwarting ($\beta = -.51$, $p < .001$). In turn, global need satisfaction was negatively associated with perceptions of devaluation ($\beta = -.17$, $p < .05$) and reduced accomplishment ($\beta = -.35$, $p < .01$), but not emotional exhaustion ($\beta = .02$, ns). Global need thwarting was positively associated with devaluation ($\beta = .43$, $p < .001$), reduced accomplishment ($\beta = .45$, $p < .001$), and emotional exhaustion ($\beta = .57$, $p < .001$). Significant indirect effects were observed for: (a) parent autonomy support on devaluation ($\beta = -.05$, $p < .05$) and reduced accomplishment ($\beta = -.09$, $p < .001$) via need satisfaction, and (b) parent autonomy support on devaluation ($\beta = -.14$, $p < .001$), reduced accomplishment ($\beta = -.12$, $p < .001$), and emotional exhaustion ($\beta = -.24$, $p < .001$) via need thwarting. The findings suggest that coach-parent interactions warrant further examination by coach burnout researchers.

" . . . and the Crowd Goes Wild!" – Performance in Elite Darts Players, the Presence of Crowds and the Simulation of a Crowd During the COVID-19 Pandemic

Jona Greve, University of Münster; Edda van Meurs, University of Münster; Bernd Strauss, University of Münster

The influence of the presence of others on motor-task performances has been studied for more than 100 years (starting with Triplett, 1898). Experimental *social-facilitation* research (typically with merely present or coactive observers; see Zajonc, 1965) shows mixed results: increased performance for motor tasks requiring condition or effort, and mostly decreased performance for motor tasks requiring coordination, accuracy, or both (see Strauss, 2002; and the recent meta-analysis by van Meurs, Greve, & Strauss, 2021). Similar results are expected when performing in front of large, active crowds that influence the performer (Wallace, Baumeister, & Vohs, 2005). Darts is a coordination-based accuracy task. Hence, we hypothesize that tournament performance of elite darts-players decreases in the presence of active spectators (RA; which can be up to 20,000) in comparison to no-audience (NA; many tournaments, even before COVID-19, were held without spectators) and simulated-audience (SA; tournaments with pre-recorded, audiotaped crowd-noise that was played during the COVID-19 pandemic). Data from all professional darts tournaments from 2018 to 2021 was retrieved from dartsorakel.com. The sample consisted of $N = 442$ players (98.8% male) and $N = 26{,}724$ individual performances. The influence of RA, NA and SA on the main performance predictors in darts – checkout percentage (CP) and three-dart average (3DA) – was analyzed using separate multilevel models allowing intercepts to vary between players (level 2). Year, player's rank, and tournament round were added as predictor variables.CP was lowest with RA, $b_{real} = -3.62$, $SE = 0.33$, $p < .001$, ICC=.015 and highest with NA. The best 3DA performances occurred with SA, $b_{sim} = 2.20$, $SE = 0.39$, $p < .001$, ICC=.26. CP specifically suffered under conditions with high distractive potential (SA or RA conditions), opposed to 3DA displayed a different pattern, where playing with SA resulted in high performances. The findings indicate that playing with RA does not result in the highest performances for both performance parameters.

E-Learning in Diabetes Prevention: Examining the Effectiveness of an Online Training Course for Diabetes Prevention Coaches

Natalie Grieve, University of British Columbia (Okanagan); Kaela Cranston, University of British Columbia (Okanagan); Mary Jung, University of British Columbia (Okanagan)

E-learning platforms have been shown to be an effective mode for teaching content and skills to health professionals, however less is known within the context of training diabetes prevention coaches. This study aimed to examine the effectiveness of an online coach training course within *Small Steps for Big Changes* (SSBC). SSBC is a community-based diabetes prevention program run in partnership with the YMCA. SSBC guides adults with prediabetes through exercise and counselling sessions using a motivational interviewing (MI) approach to help empower healthy lifestyle modifications and prevent type 2 diabetes (T2D). This program requires specific training for SSBC coaches (ie., YMCA staff) to counsel clients and guide them through the program. Originally, an in-person training workshop was held to train SSBC coaches; however, this process logistically limits training opportunities and program scale-up. As such, an online course to deliver training to SSBC coaches was developed, and effectiveness was determined using pre- and post-training questionnaires assessing knowledge of T2D, MI and SSBC content. Incoming SSBC coaches completed an asynchronous 7-module e-learning course that covered content on SSBC exercise and counselling sessions, MI skills and knowledge, and general T2D information. These modules were followed by a virtual mock client session for coaches to practice skills and apply their leaning. MI knowledge ($M_1 = 4.00$, $SD_1 = 1.63$, $M_2 = 6.14$, $SD_2 = 0.90$; $P < .05$), and SSBC content knowledge ($M_1 = 5.00$, $SD_1 = 1.82$, $M_2 = 8.29$, $SD_2 = 0.95$; $P < .05$) significantly increased from pre- to post-training. Increases in diabetes knowledge did not reach statistical significance ($M_1 = 7.43$, $SD_1 = 1.90$, $M_2 = 8.43$, $SD_2 = 0.79$; $P = 0.11$). This study demonstrates promising results for e-learning in the context of novice SSBC coaches and can be adapted to other diabetes prevention coaching contexts. This online coach training will allow SSBC to train more coaches, expand to locations across Canada, and ultimately reach more adults living with prediabetes.

On the Same Page: Congruence of Efficacy Beliefs Predicts Performance of Athlete Pairs

Christine Habeeb, East Carolina University; Sarah Stephen, University of Stirling

The positive efficacy-performance relationship has been well documented in sport literature for over four decades (e.g., Feltz et al., 1979). Efficacy beliefs targeting personal (i.e., self-efficacy), teammates' (i.e., other-efficacy), and conjoint (i.e., collective efficacy) abilities are each uniquely associated with the performance of athlete pairs and larger sized teams (Habeeb et al., 2019; Lent & Lopez, 2002; McLean et al., 2020). There is limited empirical evidence, however, of (1) how congruence of efficacy beliefs between athletes relates to their performance and (2) if congruence at high and low levels of efficacy would predict performance in the directions theorized by Bandura (1977). The purpose of this study was to examine the extent to which efficacy congruence within athlete pairs predicts individual- and team-level performances. Sixty-six cheerleading pairs competing in a national competition completed questionnaires assessing self-, other-, and collective efficacy prior to the competition. Performance of the dyadic tasks were assessed using objective criteria for individual and team performance. Polynomial regression analyses were used to examine how congruence was related to individual and team performance followed by the creation of response surface plots to depict significant interactions. Results indicated that congruence of both athletes' self-efficacy (incongruence curvature = -0.17, $p < .05$) and both athletes' collective efficacy (incongruence curvature = -0.53, $p < .05$) predicted team performance while congruence of other-efficacy (incongruence curvature = -0.38, $p < .05$) predicted both athletes' individual performances. That is, paired athletes that reported similar levels of efficacy (at both high and low levels of efficacy) were likely to perform better individually and as a team, while paired athletes that reported dissimilar efficacy beliefs were likely to perform relatively worse. Findings support the need for practitioners to get team athletes on the same page rather than simply increasing efficacy within each individual athlete.

Goal Conflict and the Intention-Behaviour Relationship in Emerging Adulthood

Imran Haider, McMaster University; Steven Bray, McMaster University; Matthew Kwan, Brock University

The transition into emerging adulthood is associated with rapid declines in physical activity (PA). While many emerging adults have intentions to engage in regular PA, evidence suggests the ability to act on these intentions represents a significant challenge. The pursuit of multiple goals across several facets of life, including work, school, and PA during this transition, prompts a need to balance or prioritize among several motivations. Given that time and energy are limited resources, goal conflict arises when pursuit of multiple goals interferes with PA intentions. The purpose of this study was to investigate the potential moderating effect of goal conflict on the intention-behaviour relationship during emerging adulthood. A subsample of 140 participants ($M_{age} = 17.78 \pm 0.47$; 62% female) were drawn from a larger prospective cohort study (ADAPT Study). Intention strength and anticipated goal conflict were measured at Time

1 and self-reported moderate-to-vigorous physical activity (MVPA) was assessed at Time 2, approximately 4 weeks later. A linear regression model predicting MVPA was significant ($p < 0.01$), with a strong main effect ($p < .01$) of intention; however, the main effect of anticipated goal conflict ($p = .11$) and the interaction effect ($p = .50$) were not significant. Post-hoc decomposition of the interaction showed intention was a significant predictor of MVPA at all but the highest levels of goal conflict. Interestingly, intentions and anticipated goal conflict ($r = -.233$) were significantly correlated ($p < .01$), suggesting participants may have implicitly factored in the impact of their other goal pursuits when reporting their PA intentions. Additional analyses are planned to assess the effects of participants' retrospective evaluations of goal conflict relative to anticipated goal conflict. In light of the relatively small sample size, future research should pursue further examination of goal conflict as a barrier to MVPA and potential modifier of the intention-PA relationship during emerging adulthood. Funding source: SSHRC.

The Effect of Acceptance-Commitment Therapy Based Psychological Skills Training for Shooting Athletes

Woori Han, Korea National Sport University; Duksun Chang, Korea National Sport University

The purpose of this study is to understand the relationship between ACT process variables and psychological factors by developing and applying an ACT-based psychological skills training program for shooting athletes.This study is an Non-Equivalent Control Group Design and consists of a total of 28 people in the control group and the experimental group. The program was applied to 14 shooting athletes(Man=5,$Woman$=9, M_{age}=20.64 ±.6) an experimental group, 10 times, 60 minutes per session and in a non-face-to-face manner. The tests scores collected during the training were verified for factor through SPSS two-way repeated measure ANOVA. To verify the relationship between ACT process variables and psychological factors, a correlation analysis through R was applied to present a heatmap and correlation matrix, and was verified by SPSS multiple regression analysis. As a result of analysis, it showed effects in concentration($F = 5.519$,$p = .007$) and goal setting($F = 4.992$, $p = .010$) among sports psychology skills($F = 7.621$,$p = .001$) and detailed factors, cognitive defusion (F=4.867,p=.012) among ACT process variables, self as context(F=6.743,p=.009), commitment action(F=3.974,p=.025), and psychological flexibility(F=7.301,p=.002). In the relationship between ACT and psychological skills, influence was confirmed in value/self as context and confidence ($t = 3.267$**/$t = 2.362$*, $F = 8.590$**, $R^2 = .610$), being present/cognitive defusion and goal setting ($t = 2.892$*/$t = 2.277$*, $F = 6.612$*, $R^2 = .546$), psychological flexibility and team balance($t = 3.599$**,$F = 12.953$**,$R^2 = .519$), self as context and imagery ($t = 2.281$*, $F = 5.204$*, $R^2 = .302$), committed action and willpower ($t = 2.411$*, $F = 5.812$*, $R^2 = .326$).Therefore, this training is judged as a psychological intervention that promotes process variables of ACT, improves the psychological skills of athletes, and maintains their effects, and it is expected to provide basic data to the psychological skills training site by identifying the relationship between the process variables of ACT and psychological factors.

Effects of Mental Fatigue and Message Framing on Physical Activity Effort Discounting

Sheereen Harris, McMaster University; Jade Mardlin, McMaster University; Steven R. Bray, McMaster University

Most North Americans do not accumulate sufficient moderate-vigorous intensity physical activity (PA) to meet current PA guidelines. Mental fatigue (MF) has been shown to amplify perceived effort costs of PA and decrease the likelihood of choosing to engage in PA vs. a sedentary alternative. Messages focusing on the gains or losses associated with PA may be an effective means of enhancing motivation for PA. This study examined the effects of MF and message framing on motivation for engaging in PA using an effort discounting paradigm. Participants ($N = 204$) were randomized to one of three groups and exposed to gain-framed (GF) messages about benefits of being physically active, loss-framed (LF) messages about risks of not being physically active, or a no message (NM) control group. Next, they made a series of hypothetical choices between engaging in PA of three intensities [light, moderate, vigorous] crossed with six durations [10, 20, 30, 40, 50, 60 minutes] for a fixed reward ($20) or a sedentary task for varying reward amounts ($2-$20). A point of indifference score (POI), representing the monetary value at which the PA and sedentary options would be chosen equally was computed for each intensity-duration combination and used as an indirect measure of motivation. Results showed a significant crossover interaction effect between message frame X MF ($p < .001$). Post-hoc comparisons of slope estimates revealed PA motivation was lower at low levels of MF and increased as mental fatigue increased in the GF ($p = .04$) and NM ($p = .007$) groups with no difference between both groups ($p = .82$). In contrast, motivation was higher in the LF group than the GF/NM groups at lower levels of MF and decreased as MF increased ($p = .001$). Findings suggest the effects of message framing may depend on MF with LF being more effective at lower levels of MF and GF being more effective at higher levels of MF. Findings may be useful to inform the development of messaging interventions adapted to momentary variations in people's psychological and affective states.

The Effects of Virtual Reality on Anxiety and Performance in Female Soccer Players

Kaitlyn Harrison, Texas Christian University; Emily Potts, Texas Christian University; Adam King, Texas Christian University; Robyn Trocchio, Texas Christian University

With the increased use of technology, relaxation interventions are finding their way into technology devices like virtual reality head mounted displays (VR HMDs). However, there is a lack of evidence on the efficacy of VR relaxation interventions to reduce anxiety in athletes and how that is portrayed in their movement patterns. The purpose of the current study was to examine how a VR relaxation intervention affected perceived anxiety levels and penalty kick performance of female soccer players. Thirteen female soccer players took five penalty kicks in baseline, stress-induced, and VR relaxation conditions. Perceived levels of anxiety, self-confidence, mental effort, heart rate, accelerometry of the lumbar spine and thigh, and performance in each condition was obtained. Results indicated that the VR intervention significantly reduced cognitive anxiety and somatic anxiety from baseline ($p = .002$; $p = .001$) and stress ($p < .001$; $p < .001$) with a large effect sizes (Kendall's $W = .72$; .83). VR significantly increase self-confidence from baseline ($p = .002$) and stress ($p = .001$) with a large effect size (Kendall's $W = .71$). Also, all participants felt the VR helped them relax. Mental effort was significantly higher in the stress condition compared to baseline ($p = .007$) with moderate effect size (Kendall's $W = .39$). Peak acceleration and performance were not significantly influenced by stress or VR. This study serves as an initial step to evaluate VR relaxation interventions on performance in female soccer players. Funding source: Texas Christian University Harris College of Nursing and Health Sciences Student Research Grant.

Solitary and Social Components of Campus-Based Virtual Physical Activity Support: Uptake and Associations With Outcomes

Adrian Haughton, Southern Connecticut State University; Phillip Bodurtha, Southern Connecticut State Univeristy; Jessica Scibek, University of New Haven; Robert Axtell, Southern Connecticut State University;

Matthew Stults-Kolehmainen, Yale New Haven Hospital; Garrett Ash, VA Connecticut Healthcare System

Mobile monitoring to maintain and increase PA has become increasingly popular, partly due to strategic gamification strategies that promote PA through social connectivity. We previously reported it was feasible to implement a mobile PA intervention for a college campus during COVID-19 that combined solitary (goal-setting, motivational messages, escalating prize-based contingency management, active self-monitoring, PA feedback) with social components (add and compete with friends about daily PA metrics, teams pursuing cooperative in-game PA goals). However, undergraduate students had lower enrollment, days of retention (DoR), and steps per day of retention (SDoR) than faculty. To better understand the sources of this disparity, we herein assess whether the number of daily app engagements (ENG), the number of in-game friends (FRI), and the number of teammates (TM) differed between students and faculty, and if these usage metrics were correlated with DoR and SDoR. Users (n=154 undergrads, 56 grads, 125 faculty) downloaded the app (MoveSpring™) from a campus-wide email invitation and synced it with their personal smartphone or fitness watch for step-counting. All outcome and usage metrics were exported by the app manufacturer and transferred to the program directors. Due to non-normal distributions, we utilized the Kruskal-Wallace (H) test and Spearman (ρ) correlations, with significance <.05. Higher academic status was associated with greater ENG (median [IQR] undergrad 0.8 [0.4,1.7], grad 1.4 [0.7,2.7], faculty 1.3 [0.7,2.7]) ($H = 14.5$, $\rho = .001$) but not FRI (undergrad 2 [0,3], grad 1 [0,4], faculty 2 [0,3]) ($H = 0.5$, $\rho = .77$) or TM (undergrad 9 [6,10], grad 9 [5,10], faculty 8 [6,10]) ($H = 0.1$, $\rho = .93$). DoR and SDoR correlated with ENG ($\rho = .36/.41$) and FRI ($\rho = .28/.31$) ($p < .001$) but not TM ($\rho = -.04/-.06$) ($p > .30$). We conclude that undergraduate students were engaged comparably to faculty on the social but not solitary components of the app. Both such components were associated with retention and PA outcomes and warrant further attention to improve student engagement. Funding source: Office of Academic Affiliations Fellowship at the United States Veterans Health Administration, American Heart Association #852679, Robert E. Lee and Clara Guthrie Patterson Trust Mentored Research Award, Bank of America, N.A., Trustee.

You're Still Muted! Pro-Active Learning in Virtual Sport Psychology Classes

Emily Heller, Waubonsee Community College; Karisa Kuipers, Northern Illinois University

Two years post the pandemic onset, virtual learning is ubiquitous in education and will be for the near future. While online classes allow for continuity of learning and progress on degree requirements during a public health crisis, there are associated challenges that present differently than in a traditional classroom such as student engagement, interactions with and among students, and building rapport. Learning engagement is multi-dimensional and often displays four pivotal characteristics: a) action-based, b) context-specific, c) object-oriented, and d) dynamic (Reschly & Christenson, 2012). However, the academic literature is replete with theoretical and practical suggestions to promote active learning at the college level, but these are generally applied in traditional face-to-face course delivery (Reschly, Pohl & Christenson, 2020)."Unmuting" deep learning in virtual contexts for undergraduate sport psychology courses is the objective of this presentation. Three strategies for deepening students' learning online by engaging them in the learning process will be presented. These pedagogical approaches include: a) how to begin online classes with an unofficial start and provide a context hook to clarify the intention of the class meeting (Littlefield & Wise, 2021), b) how to foster connection before content so that students can connect to the purpose of the class and to each other (Littlefield & Wise, 2021), and c) how to enrich the course content by converting hands-on activities to virtual formats. Collectively, these strategies will enable sport psychology instructors to support online student success. The strategies presented will promote a collaborative approach for students that will help create an online learning environment characterized by connection and engagement.

Leveling the Playing Field in High-Cost Sports for Historically Underrepresented Youth

Emily Heller, Waubonsee Community College; Jason Chatman, Waubonsee Community College

Given 44 million youth participate in organized sports (Weinburg & Gould, 2019), there is a need to create inclusive and welcoming environments for all youth athletes. However, to further NASPSPA initiatives to promote equality, examination of some root causes for disparate participation in sports by diverse young athletes is crucial. As the literature promoting the benefits of diversifying youth sport has grown more prolific over the past few decades (Andrews et al, 2017), the need to create equitable environments for youth sport participants is imperative. One economic disadvantage is the affordability of equipment (e.g., ice hockey) in high-cost youth sports (HCYS). Underrepresented children are more likely to live in urban spaces and attend underfunded schools (Noel, 2018) which often make HCYS inaccessible. Economic exclusion often translates into racial exclusion. HCYS are often defined as "White sports" and may pose cross-cultural stressors on participation. Psychological pressures of perceived racism may challenge the core identities of young athletes of color who risk imposter syndrome, discrimination, and other threats. Policies to promote race equality, including diversity and racism training, are often inadequate (Normal et al., 2014). Increasing awareness of adult leadership in HCYS to develop inclusion of young athletes of color will be discussed in this presentation. The purpose is twofold: to challenge attendees to foster diverse cross-cultural participation to minimize economic oppression often apparent in HCYS, and to make practical recommendations for coaches and sports sponsors to promote equal opportunities for participation in HCYS. The suggestions offered will challenge coaches and sponsors to find and open gateways into HCYS. Goals of diversity and inclusion for underrepresented young athletes to participate in HCYS from which they have been historically excluded can be actualized.

The Comparative Effects of Exercise and Transdermal Trigeminal Nerve Stimulation on Psychological Feeling States

Shaine Henert, Northern Illinois University; Christopher Hill, Northern Illinois University; Juan Navarro, Northern Illinois University; Benjamin Connors, Northern Illinois University

The emotional well-being of college students has gained significant attention, especially during the COVID pandemic. Emotional well-being involves more positive affect than negative affect in one's life. Although exercise has been shown to improve affective states, few young adults engage in recommended amounts of regular exercise. Transdermal trigeminal nerve stimulation (e.g., Thync stimulation) has shown promise in improving one's anxiety, but little is known about its effect on affective states. The purpose of this study was to examine the comparative effects of acute MVPA and transdermal stimulation on one's perceptions of positive and negative affect. Twenty-two, healthy, college-age participants completed initial screening of anxiety (STAI) and cardiorespiratory fitness (Gerkin protocol treadmill test). Participants then completed three randomized, counterbalanced, 15-minute conditions: 1) sitting quietly, 2) Thync simulation, and 3) submaximal treadmill. During each condition, participants also viewed a counterbalanced and randomized slide show depicting images that were meant to elicit an emotional response (i.e., International Affective Picture System – IAPS). Each session was

separated by 48 hours and was performed at the same time of day (+/- 2 hours). Positive and negative affect were measured at three time points during each session using the PANAS – before condition, after condition, and after viewing IAPS. A 3 (condition: treadmill, Thync stimulation, sitting quietly) x 3 (time: 1, 2, 3) repeated measures ANOVA revealed a significant condition x time interaction ($p = .015$, partial $\eta^2 = .134$) and main effect for time ($p = .002$, partial $\eta^2 = .256$) for positive affect. Follow-up analysis indicated that participants reported significantly lower positive affect during the quiet sitting condition (27.86 +/- 10.08) compared to both the exercise ($p = .007$, 32.55 +/- 7.16) and Thync stimulation ($p = .021$, 31.82 +/- 9.40) conditions at time point 3. Results suggest that a short bout of MVPA and/or Thync stimulation improves one's positive affect.

The Effects of Covid-19 on the Mental Health of College Athletes

Cameron Hirahara, Vanguard University of Southern California; David Chavez, Vanguard University of Southern California; Diana Avans, Vanguard University of Southern California

The purpose of this study was to evaluate how Covid-19 impacted the mental health of student athletes within the National Association of Intercollegiate Athletics (NAIA) during the 2020-2021 competition seasons. Student-athletes are faced with a variety of stresses every season, therefore, maintaining good mental health is critical. It was necessary to investigate how the additional stressor, Covid-19, impacted mental health. A survey was given to 127 collegiate athletes within the Golden State Athletic Conference (GSAC). The survey used the Depression, Anxiety, and Stress Scale (DASS-21) along with COVID-19 specific questions. Results showed that athletes reported their athletic performance was moderately affected by the pandemic (48%). Some reported having less time for practice and training (43%) while others reported having more (21%), a need to make academic adjustments, being less motivated to complete work (72%), and being given more homework than normal. The DASS-21 has three subscales with maximum scores of 42 for each. The means for the subscales were Depression, $M = 17.17$, $s = 11.32$; Anxiety, $M = 13.32$, $s = 10.05$; Stress, $M = 19.97$, $s = 11.31$. There were significant differences on the three subscales based on gender with female athletes reporting higher levels ($p = .0001$). An ANOVA with post hoc analysis determined differences by class level. Freshmen scored significantly higher on the anxiety subscale than juniors ($p = .039$) and generally higher than on all scales. With above median responses on the DASS-21, athletic administration and faculty need to be aware of the mental affects that COVID-19 has had, and to take this into account if another situation such as this occurs. The athletes stated that stress increased because communication was not clear and consistent. Although they acknowledged the novelty of the situation, clear, concise, frequent communication is needed. We recommend a similar "return-to-play" study.

Counselor-Client Interactions During Physical Activity Counseling Sessions for Adults With Spinal Cord Injury: A State Space Grids Analysis Study

Femke Hoekstra, University of British Columbia; Kathleen A. Martin Ginis, University of British Columbia; Delaney Collins, Dalhousie University; Miranda Dinwoodie, University of British Columbia; Jasmin Ma, University of British Columbia; Sonja Gaudet, University of British Columbia; Diane Rakiecki, University of British Columbia; SCI Exercise Counseling Panel-; Heather L. Gainforth, University of British Columbia

Studies on physical activity (PA) counseling have mainly focused on identifying which behavior change techniques (BCT) are delivered by a counselor. Less is known about how BCT are received by clients. State Space Grids (SSG) is a dynamic system method that can be used to study interactions between counselors and clients by examining frequency, duration and sequence of BCT delivery and receipt. This study demonstrates how to use SSG to 1) characterize counselor-client interactions during PA counseling sessions for adults with spinal cord injury (SCI), and 2) correlate these interaction measures to clients' PA level prior to the session. This secondary data analysis study used data from adults with SCI ($n = 12$; 67% males, 44±13 years) who participated in a PA counseling intervention. Transcripts of 12 audio-recorded intake sessions (total duration: ~4.7 hours) were double-coded for BCT delivery and receipt statements using a reliable coding method (> 84% agreement) and analyzed using SSG methods. The SSG analyses revealed that frequency, duration, and sequence of BCT delivery and receipt varied largely between dyads. Across all sessions, the counselor and client spent on average 32% of their time talking about BCT related to Goals and Planning, 39% of their time talking about other BCT (e.g., self-belief, support strategies), and the remaining 29% of their time talking about other topics (not BCT-specific). Spearman's coefficients showed no significant correlations (ranges: -.4-.5; $p > .05$) between any of the interaction measures and clients' self-reported PA at baseline. This study showed how dynamic system methods can be used to characterize counselor-client interactions and illustrate the variability and complexity of how BCT are delivered by a counselor and received by clients in a PA counseling intervention. These insights are being used to inform the creation of evidence-based best practices for SCI-specific PA counseling. Studying counselor-client interactions can provide new ways to understand and improve PA counseling for adults with and without SCI. Funding source: Craig H. Neilsen Foundation.

Associations Between Organized Sport Participation and Mental Health Difficulties Among US Children and Youth

Matt D. Hoffmann, California State University, Fullerton; Joel D. Barnes, Independent Researcher; Mark S. Tremblay, Children's Hospital of Eastern Ontario Research Institute; Michelle D. Guerrero, Children's Hospital of Eastern Ontario Research Institute

The purpose of this study was to examine cross-sectional associations between organized sport participation and mental health difficulties among US children and youth. The data (Release 3.0) were from the Adolescent Brain Cognitive Development (ABCD) study. The ABCD study is a longitudinal study exploring brain development and health in a broadly representative sample of 11,235 US children and youth aged 9 to 13 years. Child and youth mental health difficulties were assessed using the Child Behavior Checklist—a survey completed by parents/guardians. Children and youth were categorized into one of four groups based on their participation in organized sport: 1) team sport, 2) individual sport, 3) team and individual sport, and 4) no sport participation. Data were analyzed using negative binomial regression. Participation in team sport compared to no sport participation was associated with 10% lower anxious/depressed scores, 19% lower withdrawn/depressed scores, 17% lower social problems scores, 17% lower thought problems scores, and 12% lower attention problems scores. Participation in team sport compared to no sport participation was also associated with 20% lower rule-breaking behavior scores for females. Conversely, participation in individual sport compared to no sport participation was associated with 16% higher anxious/depressed scores, 14% higher withdrawn/depressed scores, 12% higher social problems scores, and 14% higher attention problems scores. Participation in both team and individual sport compared to no sport participation was associated with 17% lower rule-breaking behavior scores for females. The results align with previous research suggesting team sport participation should be encouraged as a vehicle to promote children's and youth's mental health. The finding that individual youth sport participants may be at increased risk for mental health difficulties

(relative to no sport participants) is a novel contribution to the literature and requires further investigation.

Psychosocial Predictors of One's Support or Condemnation of Colin Kaepernick

Danita Hohl, California State University, Northridge; Mark P Otten, California State University, Northridge

In 2016, Colin Kaepernick brought the fight for social justice to the forefront of the football field by kneeling in protest of racial inequality. Following this, there was a noticeable disconnect in the way the media framed these protests. The purpose of the following study was to analyze the psychosocial predictors of one's support or condemnation of protests during the National Anthem, independently of political affiliation. 400 undergraduate students at a university in California completed an online form that included items assessing empathy, news preferences, dichotomous thinking, system justification, political orientation,and two forms of patriotism. Participants then indicated their support of protests during the national anthem on a sliding scale. Not surprisingly, conservatism and watching Fox News were related to a decrease in support for Kaepernick (r = -.294, p < .001; r = -.272, p < .001). Interestingly, both forms of patriotism were correlated with lack of support for racial justice protests (r = -.400, p < .001; r = -.173, p = .017). Furthermore, system justification beliefs correlated with lack of support for protests (r = -.469, p < .001) and positively related to both forms of patriotism (r = .521, p < .001; r = .442, p < .001). Neither dichotomous thinking nor empathy were found to relate to support of Colin Kaepernick, which may insinuate that people believe themselves to be more empathetic than in actuality. Finally, gender was significantly related to overall support, with females indicating more support for Kaepernick at all time points. The overall effect size for all of our variables was large (r = .604), with system justification and both forms of patriotism accounting for the largest percentage of variability in support for Kaepernick (R-squared change = .199). The implications of this research are further discussed in terms of how patriotism may be interpreted in the United States and why those who support protests may distance themselves from the term "American".

Exploring the Motivational Profiles of Amateur Triathletes

Kim Hollingdale, California State University, Northridge; Mark P Otten, California State University, Northridge

This study examined data from 594 triathletes, of a variety of backgrounds, to identify existing motivational state differences between male and female triathletes, long course versus short course triathletes, and 'top performing' versus 'participating for pleasure' triathletes. Data was gathered via a digital questionnaire that included popular, prevalidated motivation assessment measures – the Basic Psychological Need Satisfaction and Frustration Scale (BPNSF), the Exercise Regulation Questionnaire (BREQ-3) and the Sport Motivation Scale (SMS-28). Utilizing t-test statistical analyses, significant motivational profile differences were identified between male and female triathletes and top performing versus 'just' participating athletes. Mean comparisons suggested that male triathletes are less self-determined than their female counterparts, placing greater motivational emphasis on extrinsic, rather than intrinsic factors, while female athletes reported higher levels of need frustration. Multiple significant differences were also found in the motivational profiles of top performing triathletes when compared to those that were participating for pleasure, including on 3 BREQ-3 subscales, 3 SMS-28 subscales (Intrinsic motivation to know, Intrinsic motivation to experience, and Extrinsic Regulation), and 5 BPNSF subscales: Autonomy Satisfaction, Autonomy Frustration, Relatedness Frustration, Competence Satisfaction, and Competence Frustration. Post hoc examination revealed that the top performing athletes scored higher than 'just participating' athletes on the measures of self-determined motivational styles and scored lower than 'just participating' athletes on the two BPNSF frustration scales. The study suggests that a far greater variety of motivational profiles are already present amongst the triathlon community than may have been previously assumed. The identification of a motivational profile that correlates with greater success lays the groundwork for research-informed training programs that could potentially aid athletes in performance improvements.

Exercise-Related Social Comparisons and Body Image Flexibility in Women: A Four-Sample Replication of the Moderating Effect of Self-Compassion

Katarina L. Huellemann, Western University; Kelsey Sick, Western University; Eva Pila, Western University; Rachel M. Calogero, Western University

Body image flexibility refers to an individuals' ability to pursue meaningful and valued behaviors, such as exercise, even in the face of body-related threats. Exercise-related social comparisons are sources of body-related threats for women which may produce self-critical thoughts and feelings, and subsequently impact body image flexibility. Self-compassion, which involves taking a kind and mindful stance towards self-criticism, may buffer the extent to which exercise-related social comparisons impact body image flexibility. The present research examined whether self-compassion moderated the relation between exercise-related social comparisons (in the form of body and exercise comparisons) and body image flexibility in women across four samples. In Study 1 (N = 177, M_{age} = 19.30, SD = 1.44), women participants completed a cross-sectional online survey with measures of body and exercise comparisons, self-compassion, and body image flexibility. Moderation analyses revealed a significant interaction between body comparisons and self-compassion, b = .22 (p = .009), and exercise comparisons and self-compassion, b = .18 (p = .043), indicating that the negative association between exercise-related social comparisons and body image flexibility was weaker at higher levels of self-compassion. Study 2 (N = 279 women, M_{age} = 18.90, SD = 1.36) involved a direct replication of Study 1, while Study 3 (N = 145 women, M_{age} = 19.94, SD = 1.93) and Study 4 (N = 113 women, M_{age} = 19.84, SD = 2.33) examined the prospective interaction effect of exercise-related social comparisons and self-compassion on body image flexibility 2 weeks later. Findings across the latter three studies did not replicate the moderating effect of self-compassion. The findings point to the importance of replication studies to clarify the reliability and size of observed effects, suggesting that while exercise-related social comparisons are meaningful predictors of body image flexibility in women, the extent to which self-compassion moderates this association should be critically appraised.

Development of Shooting Proficiency Scale: The Role of Coping Flexibility and Rumination

Su Young Hwang, Korea national sport university; Duk Sun Chang Korea national sport university

This study aimed to develop a scale that measures the marksmanship proficiency of elite shooting athletes (Study 1) and test its validity (Study 2). For the development of items on techniques affecting shooting performance, in Study 1, we examined previous research, conducted a content analysis on the result from a questionnaire administered to 38 Korean elite shooting athletes, and consulted with experts about the items. The preliminary items (k=179) developed were then verified using a factor analysis, goodness-of-fit indices analysis, and face validity analysis; this procedure

resulted in 58 items in 7 constructs (condition control, first shot preparation process, gun and aiming, minimization of muzzle movement, firing process, trigger tracking, psychological strategy), whose reliability were .60 or more. Study 2 tested the final scale for its validity by investigating whether the degree of perfectionism (upper; lower), gender (male; female), affiliation (middle school; high school; university; vocational team), and/or age (under 19; 20–29; over 30) affect the marksmanship proficiency, shooting skill rumination, and/or coping flexibility. The analysis on 461 Korean athletes' responses showed significant differences in marksmanship proficiency by affiliation, age, and the perfectionism degree and in shooting skill rumination by the perfectionism degree. For coping flexibility, there was a significant difference only in the perceived coping factor, arising from the perfectionism degree, gender, affiliation, and age. Furthermore, our structural equation model on the constructs of shooting technique rumination and coping flexibility showed that the scale for marksmanship proficiency has a relationship with those constructs. The final research model also revealed an indirect positive effect of marksmanship proficiency on coping flexibility through shooting skill rumination. In sum, we expect the developed scale to serve as an objective measure for the evaluation of shooting skills, thereby providing a useful training guideline for shooting athletes and supervisors.

The Power of Breath Manipulation: Can Breathing Techniques Affect Psychological Aspects of Sport Performance? A Systematic Review and Meta-Analysis

Maša Iskra, German Sport University Cologne; Nina Zammit, German Sport University Cologne; Sylvain Laborde, German Sport University Cologne

One's breathing may be purposefully manipulated to reach a targeted psychological state. This strategy is highly relevant for athletes who seek to identify new ways of optimizing their performance. An advantageous state may be attained through the voluntary control of specific parameters, such as breathing frequency and depth (Russo et al., 2017). For example, slow-paced breathing (SPB) aims to induce relaxation through its effect on the vagus nerve, in turn reducing stress and improving athletes' cognitive functioning (Paul et al., 2012). Conversely, a more energized and active state may be achieved by applying fast-paced breathing (FPB) (Balters et al., 2018). This study aimed to provide a quantitative and qualitative summary of past research on the effects of breathing techniques on the psychological aspects of sports performance. By conducting a search of six different databases, 18,822 records were identified. The classification of breathing techniques led to the formation of five categories, i.e. SPB, FPB, breath-holding, voluntary hyperventilation, as well as alternate- and uni-nostril breathing. Following the exclusion procedure, 25 studies were retained for the systematic review (SR), while the meta-analyses (MAs) were run on 20 studies, attributed to SPB, breath-holding, and lastly, alternate- and uni-nostril breathing categories. The results of the MA showed a small positive effect of SPB on the psychological aspects of sports performance, however no significant effect was found regarding the other two techniques. Nevertheless, the SR suggested numerous benefits of techniques other than SPB, including improved cognitive functioning as a result of alternate-nostril breathing and a significant decrease in state anxiety after breath-holding. One of the essential implications for future research is to address the limitations related to methodology and inadequate reporting. Moreover, the field would benefit from further standardization of breathing interventions in sport as a foundation for developing comprehensive implementation guidelines. Funding source: German Sport University – HIFF L-11-10011-237-052000.

Impact of COVID-19 Pandemic on Physical Activity Among Children With Disabilities Living in Canada

Aleksandra Jevdjevic, The University of British Columbia - Okanagan; Cameron Marshall Gee, University of British Columbia, Vancouver; Femke Hoekstra, University of British Columbia – Okanagan; Joan Ubeda Colomer, Universitat de València; Tara Joy Knibbe, Abilities Centre; Kathleen Martin Ginis, University of British Columbia – Okanagan

Physical activity (PA) is an important health behavior among children due to its association with physical and mental health. As such, the World Health Organization recommends that children and youth participate in ≥60 minutes/day of moderate to vigorous PA. However, public health measures implemented to curb the spread of COVID-19 such as lockdowns, school closures, and interruptions to youth sports programs may impact PA levels in children. As children with disabilities face many additional barriers to PA participation, these children may be at an even greater risk of declines in physical and mental health due to physical inactivity during the COVID-19 pandemic. The objective of this study was to assess how the pandemic affected the PA habits of children with disabilities living in Canada. The COVID-19 Disability Survey collected responses from adults, who identified as a parent/caregiver of a child with a disability, over two survey timeframes (Survey 1: June 2020 – December 2020; and Survey 2: December 2020 – September 2021). Sixty-two respondents participated during the time-frame covered by Survey 1 (children's M age = 11.09±4.05 years) and 99 during the period covered by Survey 2 (children's M age = 11.00±3.75 years). Fifty-four percent of respondents to Survey 1 and 73% of respondents to Survey 2 indicated their child's PA habits decreased compared to before the pandemic. Further, 73% and 55% of parents/caregivers indicated that during Survey 1 and 2 time-frames respectively, their child did not meet the recommended 60 minutes/day of moderate to vigorous PA. Only 19% of respondents to Survey 1 and 16% of respondents to Survey 2 reported that their child did at least two hours of light intensity PA on every day of the previous week. Our data demonstrates the low levels of PA participation among Canadian children with disabilities during the COVID-19 pandemic. Interventions to increase PA participation in children with disabilities should be a focus of the pandemic recovery period. These data should be considered when implementing future public health measures.

Personal Development in High-Performance Norwegian Biathletes: "Going Through the Journey as a Person"

Helene Jørgensen, University of Alberta; Tara-Leigh F. McHugh, University of Alberta; Amber D. Mosewich, University of Alberta; Nicholas L. Holt, University of Alberta

Personal development includes learning and improving life and psychological skills, as well as characteristics that can help athletes deal with performance issues and personal challenges (Harwood & Johnston, 2016). The purpose of this study was to create a dimensional matrix of how to promote personal development in high-performance Norwegian biathletes. Schatzman's (1991) dimensional analysis approach was used. Individual semi-structured interviews were conducted with 22 participants from Norwegian high-performance biathlon environments. The sample consisted of 8 coaches (2 women, 6 men), 2 parents (1 mother, 1 father), and 12 athletes (9 women, 3 men, M_{age} = 22.6 years, SD = 2.8) who had competed in biathlon at national (n = 2) and international levels (n = 10). Semi-structured interviews were completed in Norwegian. Interviews were then transcribed in Norwegian and translated to English. Data were subjected to three stages of dimensional analysis (i.e., designation, differentiation, integration). The dimensional matrix highlights the contexts, conditions, processes, and consequences of promoting personal development. The *contexts* encompassed the boundaries of the environments (e.g., national teams, high-performance training centres) and situations (e.g., training, racing) associated with athletes' personal development. The *conditions* are the dimensions that facilitated/blocked (e.g., mastery, orientation) and shaped (e.g., hardships, stressors) athletes' personal development. The

process includes the athletes' actions (e.g., realistic self-evaluation, goals, aspirations) and interactions with coaches and parents (e.g., informational, emotional, tangible supports) influencing personal development. As a *consequence* of these actions-interactions, athletes were able to experience personal development as a means of evolving and improving their mental, psychosocial, and performance areas. The dimensional matrix will be used to design a personal development program for high-performance athletes. Funding source: The IOC Olympic Studies Centre PhD Students and Early Career Academics Research Grant Programme.

Ethics in Junior Tennis: How the Moral Values and Sportsmanship of Junior Players are Shaped

Youngok Jung, California State University Long Beach; Aranne Jung, California State University Long Beach; Yuran Jung, California State University Long Beach

Junior tennis is one of the few sports that players are entrusted to referee their own matches and keep their own score. Unfortunately, some junior players are known to make bad calls and display poor sportsmanship behaviors during competitive matches that diminish the joy of playing tennis. This study explored how junior players' moral values and sportsmanship behaviors are shaped in tennis. Participants included 34 junior players in California (M_{age} = 15, SD = 1.66), many of whom have played tennis more than 5 years (n = 21). Descriptive analysis indicated that both junior players and parents put a higher emphasis on performance-oriented goals, good sportsmanship behaviors, and fair play than outcome-oriented goals and social-desirability goals. Coaches frequently modeled and rewarded good sportsmanship behaviors, yet rarely punished poor sportsmanship behaviors. Correlational analysis indicated that junior player's Universal Tennis Rating (UTR) was negatively correlated with good sportsmanship behaviors, including "I try to be fair" (r = -.54**), "I always play properly" (r = -41*), and "I help people when they need it" (r = -.44*) as well as performance-oriented goals, including "I improve my performance" (r = -.39*) and "I use my skills well" (r = -.37*). Junior player's UTR also showed similar negative correlations with parental values in good sportsmanship behaviors and performance-oriented goals. The most common good sportsmanship behaviors that junior players experienced include correcting incorrect calls, helping injured opponents, and showing respect at the handshake. The most common poor sportsmanship behaviors that junior players experienced include cheating line calls and game scores, loud grunting, and racquet abuse. Many junior players expressed that United States Tennis Association (USTA) should provide more referees at the tournament and remove ambiguity in the current USTA regulations on code violations and penalties. Implications are discussed with regards to the role of the USTA, UTR, and coaches in junior players' development in tennis. Funding source: Sport psychology, ethics, morality, beliefs, children.

Social Support for University Student-Athletes During the Covid-19 Pandemic

Eriko Katagami, Kyoritsu Women's University; Mikiyo Kobayashi, Osaka Ohtani University

Previous studies have shown that stressors for university student-athletes during the COVID-19 pandemic were including infection risk, economic problems, loss of opportunities for interpersonal contact, change of situation and uncertainty, adjustment to a new style of academic life, daily life, and competitive life, and organizational decisions on the COVID-19. Also, it has been reported that social support was positively associated with mental health in such stressful situations. The purpose of this study is to explore social support experienced by university student-athletes during the COVID-19 pandemic. Participants were recruited from three universities located in East and West Japan. University student-athletes who consented to participate in this study completed the online-format questionnaires. In Study 1, the participants (N = 157, male = 127, female = 30) were asked to fill out an open-ended questionnaire with questions regarding "supportive behaviours from surrounding others experienced after the COVID-19 pandemic occurred". Finally, 32 items were chosen as social support for university student-athletes under the COVID-19 pandemic. In Study 2, participants (N = 248, male = 141, female =107) rated items on a 5-point Likert scale ranging from 1 (not at all) to 5 (very often). Exploratory Factor Analysis was conducted with the maximum likelihood method and Promax rotation to examine the factorability of the scale. The results suggested that social support is composed of three factors: "F1: problem-solving support (e.g. to give information to continue sports activity, to give information to adjust to life during the COVID-19 pandemic)", "F2: emotional support (e.g. listening to my concerns, sharing the feelings)", and "F3: tangible support (e.g. provision of training equipment and tools, provision of financial assistance such as sending money). Cronbach's alpha coefficients were 0.88, 0.79, and 0.77 for F1, F2, and F3, respectively; and the coefficient for the overall scale was 0.91, indicating adequate internal consistency of the scale.

Metaphor Analysis of Student-Athletes' Perception of COVID-19 Experience

MJ Kim, Korea National Sport University; DukSun Chang, Korea National Sport University

The purpose of this study investigated that to describe the metaphorical thinking and understand perception of Student-Athlete's "Experience of COVID-19". Participants are 87 middle and high school athletes and 116 college students. Data were collected from open-ended questionnaire using online. The questionnaire conducted on consisting of daily life, study, training, and future career areas and metaphor. The collected data were categorized into inductive content analysis according to metaphor based on analysis by using the grounded theory of Saban (2007). Analysis through systematic metaphor analysis resulted in a total of 3 metaphor categories: Obstacle', 'The road not taken', 'An Oasis in the desert'. The results of inductive categorization in 4 areas based on categories were commonly reported in daily life and training areas. Maintain Social distancing was performed due to concerns over infection prevention, reducing exercise motivation and difficulty in systematic training due to absence of feedback. On the other hand, the experience of various experiences and new learning, the time of reflection through recharging, and the experience of positive emotions through efficient learning and self-directed training were recognized as meaningful events. Conclusion: The student athlete's experience with the COVID-19 incident through metaphor analysis recognized the limitations of training, the anxiety of future career due to the loss of opportunities for participation, and the change of learning environment as major difficulties. However, learning how to cope with a crisis and learning new opportunities other than exercise were also a time for positive coping experiences. Metaphors are formed based on experience and serve as filters for recognition. Metaphors play an important role in changing a person's perception and attitude, and the progress of counseling using them makes it easier to understand a person's feelings or thoughts. We hope that this research will be used as a basis for research using metaphor in psychological counseling in the sports psychology. Funding source: http://db.koreascholar.com/article.aspx?code=400187.

The Development and Application of eSports Psychological Skills Training and Counseling (ePST & C) Program Coping With Stress for eSports Athletes

MJ Kim, Korea National Sport University; DukSun Chang, Korea National Sport University

The purpose of this study is to verify the positive effects of developed and application coping with stress Psychological Skills Training and Counseling (ePST & C) program for The League of Legends(LoL) eSports Athletes. eSports is a highly competitive and stress environment. The LoL is a real-time strategy and role playing game composed of 5 players in a team, and is one of the most popular eSports games launched by Riot Games in 2009. Through an open-ended questionnaire, the stress factors and coping types were conceptualized and categorized into inductive analysis. As a result derived from 6 areas stress factors and 8 types of coping with stress. The ePST & C program was developed in consideration of the sports characteristics and coping type of LoL Athletes. Due to COVID-19, the program used an online platform that is not restricted by time and space. Participants were randomly assigned to five LoL athletes' experimental groups and five control groups. The preliminary program was conducted once, 60 minutes, and 9 sessions, and ePST & C program was conducted once and 90 minutes and 9 sessions. For quantitative analysis, TOPS 2, ACSI-28, and Team Communication scale were used conducted before, after, and 4 weeks after the start of the program. The development and application of programs was based on 3 stages of exploration, insight, and execution, which are Hill's psychological counseling process. In the exploration stage was conducted to find self-understanding and psychological strengths. The insight stage was goal setting, imagery, self-talk, breathing relaxation, and energy activation. The execution stage was the practical stage was routines, team communication skills. As a result, TOPS 2 showed the interaction effect of timing and group in all 8 factors and ACSI-28 showed in 6 factors, team communication showed in 3 factors. In future tests after the end of the program, positive effects were also confirmed in various factors. In conclusion, the application of ePST &C programs suggests that eSports athletes can be empirically applied to sports players. Funding source: http://knsu.dcollection.net/.

Physical Activity Level and Self-Perceptions Among Older Adults After 4 Weeks of Neuromuscular Electrical Stimulation Training

Lindsay E. Kipp, Texas State University; Joni A. Mettler, Texas State University

Physical activity level (PA) and quality of life (QoL) often decrease with aging, due to reduced muscle mass and physical function. Neuromuscular electrical stimulation (NMES) is a muscle strengthening modality used in physical rehabilitation, but little research exists on how NMES affects PA and QoL. Our purpose was to test whether a 4-week NMES intervention augmented PA and 2 aspects of QoL: perceived strength and self-esteem. In this clinical trial, healthy older adults (68.8 ± 7.4 yrs) were randomized into an NMES treatment (NMES: $n = 12$) or sham group (SHAM: $n = 5$). For NMES, a 40-min treatment was applied to the quadriceps of each leg 3X per week for 4 weeks. SHAM underwent the same procedures, but no electrical current was administered. Participants wore an accelerometer at the waist during waking hours, for 1 week before and 1 week after the intervention. Average daily minutes of moderate-to-vigorous intensity PA (MVPA) and light intensity PA (LPA) were calculated. A pre and post survey assessed perceived strength and global self-esteem (1-6 scale). RM ANOVAs determined intervention effects. Data are reported as mean ± SE. Perceived strength was significantly correlated with MVPA, so it was included as a covariate for MVPA, and the group-by-time interaction was significant ($p = 0.047$). Controlling for perceived strength, the NMES group significantly increased in MVPA (54.2 ± 6.5 vs. 65.5 ± 7.4 min; $p = 0.019$) and SHAM remained stable (54.7 ± 8.3 vs. 51.0 ± 9.4 min; $p = 0.493$). The group-by-time interaction was not significant for LPA ($p = 0.824$; NMES: 61.6 ± 9.4 vs. 56.8 ± 4.2 min; SHAM: 60.9 ± 11.8 vs. 59.3 ± 5.3 min). Group-by-time interactions were not significant for perceived strength ($p = 0.573$) and self-esteem ($p = 0.244$). A longer NMES intervention may be needed to change QoL outcomes. The therapeutic effects of NMES training contributed to 11 more minutes of MVPA per day for the NMES group, a medium effect. LPA trended downward for the NMES group (small effect); it is possible they substituted LPA with MVPA. Funding source: Project funded by a Research Enhancement Program Grant; Texas State University, to J.A. Mettler and L.E. Kipp and by a Research Accelerator Funding; Texas State University, to J.A. Mettler.

Human Voice as Mood Indicator After Yoga Practise

Meike Kolb, University of Münster; Tim Farwick, University of Münster

This pilot-study aims to explore the mood-parameters of human voice after yoga practise. The voice of each person is singular and not variable between people, similar to varying moods (Sendlmeier, 2012). Based on categorized voice-signal-parameters with emotional states of the human voice (Paeschke, 2003) it is possible to detect positive or negative mood in the voice. Various researches showed a positive mood after practicing sport (Schwerdtfeger, 2015). In the present study, we pioneer the employment of voice-signal-based mood detection after yoga practice. We conducted pre-post measurements at 16 practise-times for 60 minutes ($M = 31.0$ years, $SD = 13.7$ years; $N = 20$, 40% male; 18-61 years old; advanced yoga practitioners, 5 practise-times each yoga practitioner, $N = 200$ voice recordings). Each time, three equal phrases (fundamental tone, reading a story, narration) were recorded by using an app (Easy Voice Recorder). The prosodic features in human voice were analysed with a phonetic-software (www.praat.org). Additionally, a German established mood questionnaire ASTS (Dalbert, 1992; $\alpha = 0.83$ to 0.94; a short German version of POMS) was used. The results indicate that positive mood after yoga is not sufficiently reflected in the voice signals so as to allow using voice-signals as a mood indicator. There is no significant influence on the prosodic features like the pitch (male, 90-130 Hz: $t(7) = 0.305$, $p = 0.769$; female, 165-230 Hz: $t(11) = -1.145$, $p = 0.277$) and the loudness (male, $t(7) = 0.99$, $p = 0.924$; female, $t(11) = -0.409$, $p = 0.690$), while at the same time the ASTS-questionnaire shows a highly significant difference in pre-post relations ($t(22) = -4.198$, $p < 0.001$). Weak effects in the voice-based mood parameters after yoga practice request further examinations on the voice as a (mood) indicator in sports.

An Examination of the Potentially Confounding Effects of Ambient Noise on Music Exposure During Aerobic Exercise

Jason Kostrna, Florida International University

Decades of research supports the positive effects of listening to music during aerobic exercise on affect, perceived exertion, and performance. A substantial portion of this research relies on studies using incremental aerobic exercise tests in indoor settings, frequently on treadmills. These incremental tasks increase exercise intensity (e.g., speed or incline) during the test while listening to music at a constant volume. Thus, research on listening to music during incremental aerobic exercise tests is potentially confounded with increasing noise pollution resulting from higher intensity exercise (e.g., faster treadmill motor, heavier footfalls, increased respiration). The present study is the first to explore how the potential confound of ambient noise moderates attentional processes and emotional valence while listening to music during exercise. Fifty-eight university students were randomly assigned one of three conditions: (1) control – no headphones, (2) music with noise-canceling headphones, or (3) music without noise-canceling headphones. Heart rate (HR), perceived exertion (RPE), attention, and emotional state were repeatedly measured during a modified Balke and Ware test. Results indicated no significant interaction of condition and time point for

attention, HR, and RPE. A significant effect for attention was found such that the control condition had more internal association than the two music conditions. Similarly, RPE trended towards higher RPE in the control condition compared to the two music conditions. the same direction.There was no significant difference found between conditions of music with noise-canceling and without-noise-canceling headphones on any variable. These findings provide preliminary evidence that noise pollution due to increasing exercise intensity during a treadmill task does not confound existing research on the effects of music during exercise.

Prediction of Adolescents' Physical Activity Behaviour During the COVID-19 Pandemic Using the Multi-Process Action Control (M-PAC) Framework

Dusan Kovacevic, McMaster University; Steven Bray, McMaster University; Denver Brown, University of Texas at San Antonio; Matthew Kwan, Brock University

Evidence suggests COVID-19 has had a substantial negative impact on adolescents' physical activity (PA) behaviours, which may compromise the many health benefits associated with PA. Examining prospective predictors of PA during the COVID-19 pandemic may assist in developing effective PA promotion initiatives. Given the breadth of reflective, regulatory, and reflexive constructs represented, the Multi-Process Action Control (M-PAC) model offers a comprehensive framework to examine potential PA predictors. This study investigated changes in adolescents' moderate-to-vigorous PA (MVPA) during the COVID-19 pandemic, and applied the M-PAC framework to examine reflective, regulatory, and reflexive constructs to predict MVPA during the pandemic. Adolescents ($N = 579$, $M_{age} = 15.87$ ±0.43 years, 60% female) were recruited from a large school board in Ontario, Canada as part of the ADAPT study. Participants completed self-report measures of demographic, MVPA, and M-PAC variables in the Fall of 2019 (prior to the start of the COVID-19 pandemic) and again 1-year later. A paired sample t-test showed MVPA was significantly lower during the pandemic compared to before the pandemic ($p < .05$, $d = .10$). A 2-step hierarchical linear regression model was computed with the potential covariates: gender, ethnicity, and baseline MVPA in Step 1, and baseline M-PAC variables entered on Step 2 to examine potential MVPA predictors. After controlling for covariates, habit was found to be the only M-PAC predictor accounting for significant variance in MVPA, with adolescents who reported stronger PA habits prior to the start of COVID-19 engaging in greater amounts of MVPA during the pandemic. Findings suggest that the uncertainty and restrictions of COVID-19 created an environment in which people's activities were curtailed, leaving habitual MVPA routines intact and neutralizing potential effects of reflective and regulatory processes. Habit-formation strategies should be prioritized in future intervention efforts. Funding source: SSHRC.

Receptiveness to Self-Compassion: The Role of Language, Athlete Status, Gender, and Traditional Masculinity Ideology

Ashley Kuchar, The University of Texas at Austin; Mason Henegar, The University of Texas at Austin

Extant research suggests that self-compassion improves emotional well-being in a variety of populations, making it easier for people to stay motivated in the midst of life's struggles. Despite this, self-compassionate language is sometimes perceived as "soft," which can deter certain groups (e.g., athletes, men) from employing this adaptive approach. In the present study, we explored the effect of reframing a "self-compassion" (SC) workshop as a "mental toughness" (MT) workshop or a "resilience" workshop by changing the title on a recruitment flyer. Undergraduate students ($N = 474$, Mage = 20.93 ± 3.12 years, 68% women, 44% athletes) reported which workshop they would be most likely to attend. The distribution was equal across the three types of workshops, $\chi 2$ (2, 474) = 3.51, $p = .173$. Using logistic regression, we examined the role of athlete status, gender, as well as traditional masculinity and femininity ideology on receptiveness to each workshop. After controlling for race/ethnicity, fear of self-compassion, and social desirability, we found that athlete status, gender, and traditional masculinity (but not femininity) ideology significantly predicted participants' interest in the MT workshop ($n = 165$) and the SC workshop ($n = 170$). Athletes were more likely than non-athletes to attend the MT workshop (OR = 1.95, $p = .002$) and less likely to attend the SC workshop (OR = .64, $p = .041$). Similarly, men were more likely than women to attend the MT workshop (OR = 1.57, $p = .057$) and less likely to attend the SC workshop (OR = .58, p = .031). Participants who adhered to more traditional masculinity ideology were more likely to choose the MT workshop (OR = 1.60, p = .001) and less likely to choose the SC workshop (OR = .62, $p = .001$). None of our predictors were significant for the resilience workshop ($n = 139$). These results suggest that reframing self-compassion as mental toughness might be more likely to attract athletes, men, and those who adhere to traditional masculinity ideology while the language of resilience may attract a more diverse range of people.

Predicting Physical Activity During the Transition into Emerging Adulthood: A Longitudinal Examination Using the Multi-Process Action Control Model

Matthew Kwan, Brock University, Child and Youth Studies; Denver Brown, University of Texas San Antonio, Psychology; Pallavi Dutta, Brock University, INCH Lab; Imran Haider, McMaster University, Kinesiology; Steven Bray, McMaster University, Kinesiology; Ryan Rhodes, University of Victoria, School of Exercise Science, Physical and Health Education

The transition out of high school represents a period for which significant declines in physical activity (PA) behaviours occur. Recent work has shown that regulatory (i.e., self-regulated behavioural action) and reflexive (i.e., non-conscious) processes are salient factors related to PA during late adolescence; but few studies have examined how these processes may relate to changes in PA beyond what has been shown for traditional social cognitive factors as individuals transition into emerging adulthood. The aim of the current study was to apply the Multi-Process Action Control (M-PAC) model to examine whether the additions of regulatory and reflexive processes predict PA behaviours during the transition out of high school. Our sample included 413 recent high school graduates ($M_{\text{baseline-age}} = 15.91 + 0.41$; $n = 276$ female) that completed baseline and follow-up assessments as part of a prospective cohort study called the ADAPT Study. Participants completed baseline assessments during their grade 11 year, which included measures of self-reported moderate-to-vigorous PA (MVPA), instrumental/affective attitudes, perceived capability/opportunity, action/coping planning, PA identity and habit. Follow-up was conducted approximately 24 months later. Results from our linear mixed model found significant declines in MVPA over time (Estimate = 84.29, SE = 30.32, $p < .006$). Findings from our hierarchical linear regression model found that M-PAC-based variables explained 9% of the variance in MVPA during emerging adulthood, but with only habit ($b = 0.20$, $p < .05$) was a significant predictor of MVPA. Findings of the current study reinforce the need for integrative models such as M-PAC to better understand salient factors related to PA, as the additions of regulatory and reflexive processes. Implications of this work also suggest the need for interventions to use behaviour change techniques that target identity related to PA for adolescents, as this appears to be critical in helping individuals maintain PA behaviours as they make their transition into emerging adulthood. Funding source: SSHRC.

Middle-Aged Women's Participation in Real-Time Zoom Dance Sports Due to COVID-19 and Changes in Depression and Self-Resilience

Nan sook Kwon, Korea National Sport University; Eun sim Yang, Korea National Sport University

This study explores the relationship between middle-aged women's participation in contact-free dance sports and their physical, psychological, and social awareness. The participants were five middle-aged women in their 40's and 60's, and 30 dance sports real-time zoom classes were held twice a week for three months. Qualitative in-depth interviews and quantitative questionnaires were compared before and after. As the result, first, 13,48% of a negative body perception, 74.15% of a negative psychological perception, and 11.23% of a negative social perception in the interviews held before participation. Second, the interviews post the participation, 12.86% of a positive change in body perception, 32.86% of a positive change in psychological perception, 48.58% of a positive change in social perception, and 5.71% of negative change in other perception. Third, the higher the depression before the participation, the greater the depression and the higher the participants' resilience after the participation. On the other hand, the lower the depression, the smaller the decrease of depression they showed, which led to lower resilience. Fourth, the participants who had high self-resilience during the COVID-19 situation before the participation showed a lower increase of self-resilience post the participation. Their resilience also increased to a lower degree. On the other hand, the participants who complained of pain due to loss of family or illness at the time of COVID-19 showed low self-resilience before but showed a sharp increase after the classes. In conclusion, the participation in contact-free dance sports caused positive changes in areas, including the will to overcome COVID-19 and communication, which reduced depression and increased self-resilience.

Effects of Voluntary Slow Breathing on Heart Rate Variability: A Systematic Review and Meta-Analysis

Sylvain Laborde, German Sport University Cologne; Mark S. Allen, University of Wollongong; Uirassu Borges, German Sport University Cologne; Fabrice Dosseville, Normandie Université Caen; Thomas J. Hosang, Helmut Schmidt University; Emma Mosley, Solent University Southampton; Caterina Salvotti, German Sport University Cologne; Nina Zammit, German Sport University Cologne; Florian Javelle, German Sport University Cologne

Voluntary slow breathing (VSB) is used as a technique to support physical and mental well-being, as well as to enhance performance. The rationale underlying its use in sport is linked to its purported effect on the parasympathetic nervous system (PNS). However, to date, no comprehensive systematic quantitative overview exists to support this claim, a gap we aim to address by focusing on the effects of VSB on heart rate variability (HRV). Specifically, we focus on HRV parameters indexing PNS activity regulating cardiac functioning, referred to as vagally-mediated (vm)HRV. The objective of this study to assess the effects of VSB on HRV 1) during the breathing session (i.e., DURING), 2) immediately after one training session (i.e., IM-AFTER1), as well as 3) after a multi-session intervention (i.e., AFTER-INT). Six databases were searched from 1980 to 2020. Included were studies involving healthy humans and patients; with a VSB intervention (i.e., breathing frequency lower than 10 cycles per minute – cpm), compared to any control conditions with breathing frequency higher than 10cpm and without other concomitant interventions, where HRV was assessed. PRISMA guidelines were followed. The outcomes were calculated via random-effects meta-analyses. From the 1842 selected abstracts, 223 studies were suitable for inclusion (172 DURING, 16 IM-AFTER1, and 49 AFTER-INT). The effects of VSB on vmHRV were a moderate increase in the root mean square of successive difference (RMSSD) (Hedge's g=0.52, 95% CI 0.43 to 0.62) and a large increase in the low-frequency (LF) (Hedge's g = 1.49, 95% CI 1.28 to 1.69) DURING, a small increase in RMSSD (Hedge's g = 0.14, 95% CI 0.03 to 0.24) IM-AFTER1, and a small increase in RMSSD (Hedge's g = 0.32, 95% CI 0.08 to 0.56) AFTER-INT. Results indicate increases in vmHRV with VSB, DURING, IM-AFTER1, and AFTER-INT. Given the involvement of the PNS in a large range of health-related and performance outcomes, VSB exercises could be advised as a low-tech and low-cost technique for athletes, with few side-effects expected.

Ten Sessions of Vinyasa Yoga Improves Depression and Stress in College Females With Elevated Mental Health Symptoms

Danielle Lang, Auburn University; Robyn Feiss, Nationwide Children's Hospital; Shelby Osburn, Auburn University; Cody Haun, Dr. Haun's Fitness Lab; Danielle Wadsworth, Auburn University; Matthew Miller, Auburn University; Melissa Pangelinan, Auburn University

Elevated mental health symptoms are common among college students. It has been shown that elevated stress and cortisol levels are related to both anxiety and depressive symptomology. Participation in yoga has been shown to reduce perceived stress, as well as depression and anxiety symptoms in healthy populations. However, it is unclear if yoga impacts mental health for those with elevated mental health symptoms. To address this question, 22 female college students (M age = 21.31, SD age = 1.71) participated in ten sessions (1 hour/session over 10 weeks) of Vinyasa yoga. Before/after the program, participants completed the Depression Anxiety Stress Severity (DASS) rating scale as a measure of mental health symptoms. Differences in pre-test to post-test scores (total depression, total anxiety, total stress) were examined as a function of pre-test scores using linear regression. Greater differences in total depression and stress were positively related to pre-test depression and stress, respectively ($F(1,20) = 23.8$, $p < 0.01$; $F(1,20) = 7.44$, $p < 0.05$). A similar pattern was observed for anxiety but did not reach statistical significance ($F(1,20) = 1.48$, $p > 0.05$). These results suggest that the yoga intervention was more effective for those with higher baseline levels of depression and stress (i.e., greater reduction in symptoms). Additional research is needed to replicate and extend these results with a greater sample size and greater diversity (including males, greater representation of racial categories, and larger age range) to determine if this type of yoga would be effective for other populations.

Not Your Average Sport Parents: How Sport Scholars Make Decisions About Their Own Children's Sport Participation

Heather K. Larson, University of Alberta; Tara-Leigh F. McHugh, University of Alberta; Bradley W. Young, University of Ottawa; Wendy M. Rodgers, University of Alberta

In light of recent research suggesting a disconnect between research, sport policy, and practice (e.g., Larson et al., 2020), we decided to explore the perspectives of reputed sport scholars on their experiences with their own children's involvement in organized, competitive sport. In this study, we aimed to answer the question, "How do parents with academic expertise in sport make decisions about their children's sport involvement?" We recruited 11 faculty-researchers from within the United States and Canada, all of whom held doctorates in sport-related disciplines and had one or more children between the ages of 8-15 years involved in organized, competitive sport. During semi-structured interviews via Zoom, we asked questions like, "What factors do you take into account when making decisions about your children's sport and activity schedule?" and "What has caused or would cause you to end your child's participation in a sport program?" Qualitative content analysis of the interview transcripts revealed parental practices and influencing factors that appeared when making decisions about getting into and out of sport. Parents supported their children's entry into sport by

providing sampling opportunities and autonomy, although parents' sport backgrounds also came into play. Parents showed preferences for some sports over others and carefully considered the nature of their child's sport environment. The 'decision point' was noted as one of the challenges of multisport for children—being forced to decide between two sports, either due to the structure of sport or the demands of multisport participation. Parents checked in with their children regularly and for the most part, let children guide decisions about ending their participation in a sport, although they typically expected children to finish the sport season and choose a replacement activity. Although these parents made decisions that were informed by their knowledge of evidence-based best practices, they also highlighted challenging factors outside of their control that relate to the structure of youth sport.

Examining Social Support Functions Predicting Moderate to Vigorous Physical Activity in Adults Aged 55 and Older

Niana Lavallée, University of Calgary; Meghan H McDonough, University of Calgary; Jennifer Hewson, University of Calgary; Sarah Kenny, University of Calgary; Chantelle Zimmer, University of Calgary

Social support (SS) is multidimensional and has been conceptualized in a variety of ways. Previous research has identified positive associations between SS functions and physical activity (PA) in older adults. However, the relative strength of the predictive relationships between different SS functions and PA remains unclear. The present study examined the relative strength of five functions of SS (i.e., listening support, task challenge, emotional support, reality confirmation, and tangible assistance) as predictors of PA behaviour in adults aged 55 and older. It was hypothesized that greater satisfaction with the degree to which participants received each of the five functions of SS would predict greater average weekly moderate-to-vigorous physical activity (MVPA). This study included baseline data from $N = 678$ adults aged 55-86 who completed PA and SS function measures as part of a 6-month longitudinal study. The sample was 76% women, 91% White, and 49% had completed a university degree. Satisfaction with SS functions were assessed using a modified version of the Social Support Survey (Richman et al., 1993). MVPA was measured using a modified version of the Godin-Shephard Leisure-Time Physical Activity Questionnaire (Godin & Shephard, 1985). Multiple regression with the five SS functions as predictors and MVPA as the outcome was used to test the hypothesis. The regression model with all SS predictors was significant $F(4,615) = 4.00$, $R^2 = .02$ $p < .001$); but none of the SS functions emerged as significant predictors ($\beta = -.004$-$.10$, $p > .05$). Interestingly, simple regressions with each SS function indicated that individually, all were significant predictors of MVPA ($\beta = .10$-$.14$, $p < .05$), suggesting that the shared variance among the SS functions made it impossible to examine their relative predictive associations with MVPA. While the effect of SS functions is significant, though very small, there is not clear evidence that any of the functions are more important for predicting MVPA than the others. Funding source: Brawn Family Foundation.

University Peer Health Coach Experiences Providing Critical Health Education About Diets Using Motivational Interviewing

Saemi Lee, California State University, Los Angeles; Janaina Fogaca, California State University, Long Beach; Natalie Papini, Northern Arizona University; Courtney Joseph, Independent Scholar; Dawn Clifford, Northern Arizona University; Jonathan Lee, Northern Arizona University

Given the prevalence of body dissatisfaction, physical inactivity, and dieting amongst college students, providing critical health education that helps college students develop body respect and sustainable health habits is warranted. Providing critical health education about nutrition, exercise, and the dangers of dieting is one way to do just that. Although promoting non-diet, weight-inclusive approaches to health have been promising, research also shows that health educators who challenge the status quo of diet culture and weight-focused health interventions may face unique challenges. Therefore, the purpose of this study was to examine the experiences of peer educators who provide critical health education by introducing a non-diet, weight-inclusive approach to health using motivational interviewing. Five health coaches from a university health coaching program at a mid-sized southwestern university participated in a semi-structured interview. Data were analyzed by three members of the research team using Interpretative Phenomenological Analysis. We found that peer educators faced numerous challenges when introducing non-diet, weight-inclusive approaches to health such as personal struggles with weight as well as doubts about their abilities as peers to make an impact. Participants offered several strategies and solutions to their challenges such as engaging in reflective practice and using motivational interviewing to introduce new concepts. Future directions for research and training of university health coaches who provide critical health education will be provided.

eHealth to Increase Physical Activity in Adults With Obesity: A Systematic Review

Seungmin Lee, Binghamton University; Priya Patel, Michigan State University; Nicholas Myers, Michigan State University; Karin Pfeiffer, Michigan State University; Alan Smith, Utah State University; Kimberly Kelly, Michigan State University

Despite benefits of physical activity (e.g., additive effect on weight loss when combined with dietary restriction), adults with obesity are less likely than those of normal weight to meet public health guidelines for physical activity, such as 150-min per week at moderate intensity. A type of intervention with use of information and communication technology to improve health, known as eHealth, is emerging in healthcare and presents opportunities to increase physical activity in adults with obesity. The purpose of this study was to systematically review eHealth intervention studies to increase physical activity in adults with obesity. Five electronic databases were used: PubMed, CINAHL, Cochrane, PsycINFO, and Embase. Two researchers independently screened articles, assessed risk of bias, and extracted data. A qualitative data synthesis for summarizing the findings was conducted using a harvest plot to present a visual effect. In the search, 2276 articles were identified. In the study selection, 18 studies met all inclusion criteria. Study quality ranged from poor to good according to the assessment. The included studies varied in intervention technology (e.g., web, mobile phone, physical activity monitor), physical activity assessment (e.g., self-report based, device-based), and control group (e.g., wait-list, standard care, standard eHealth). Behavioral change techniques used in the included studies were consistent with some techniques (e.g., self-monitoring, goal-setting) known to be effective in face-to-face interventions, but perhaps are more efficiently used in eHealth by employing information and communication technology. Overall, this systematic review study showed that a web-based or physical activity monitor-based eHealth intervention could increase physical activity in adults with obesity. Multiple recommendations and considerations for future eHealth research to increase physical activity in adults with obesity stem from this review (e.g., theory, mediation analysis, unique barriers in adults with obesity, accelerometers, effectiveness trial).

Examining the Developmental Networks Within a Wheelchair Rugby Team

Jordan Lefebvre, University of Queensland; Danielle Alexander, McGill University; Shane Sweet, McGill University; Gordon Bloom, McGill University

Grounded in social network theory, the developmental network perspective stipulates that people acquire a network of developmental agents (e.g., mentors) who help their personal and athletic development. Given that people with impairments have reported that personal relationships with peers, coaches, and family play an important role in their sport experience and sport-related development, the purpose of this study was to examine the developmental networks of athletes in a wheelchair rugby team (i.e., who contributes to their development and in what ways). The study used a convergent mixed-methods design embedded within an instrumental case study (i.e., wheelchair rugby team). Participants included seven wheelchair rugby athletes (five male; two female) and seven non-athletes linked to the team (one current coach/romantic partner, three parents, one kinesiologist, and two administrators). Data were gathered via social network questionnaires, semi-structured interviews, and unstructured interviews. Despite the small size of their networks ($M = 6$), the findings showed that wheelchair rugby athletes' developmental networks were highly diversified and included developmental agents directly linked to the sport environment (i.e., peers, coaches) and outside the para sport environment (i.e., family, romantic partners, and rehabilitation specialists). Furthermore, the quality (i.e., strength) of the relationships appeared to vary as a function of the type of developmental agent (e.g., coaches vs. peers), which led to distinct developmental contributions, such as integration into the wheelchair rugby community, continued participation in this para sport, and athletic growth. By situating athletes' social support systems within the developmental network perspective, this study provides empirical, conceptual, and methodological advancement for understanding the role of developmental relationships in sport-related development of para sport athletes.

Recollections of Physical Activity From Childhood With Reports of Affective Exercise Experiences During Adulthood

Jace Leininger, Iowa State University; Panteleimon Ekkekakis, Iowa State University; Spyridoula Vazou, Iowa State University

Purpose: The transition from childhood to adolescence is accompanied by a substantial decrease in physical activity (PA), followed by an even greater decline during the subsequent transition from adolescence to adulthood. Interventions aimed to increase PA by changing cognitive mediators have limited efficacy. Affective exercise experiences may uniquely contribute to PA behavior. This study examined affective exercise experiences from childhood as recalled during adulthood.Methods: An online survey was completed by 1739 adults (1093 women, M_{age}=27.15±12.65 years). Demographics, recalled PA experiences from childhood, and reports of present-day affective exercise experiences, using the Affective Exercise Experiences questionnaire (AFFEXX; Ekkekakis et al., 2021), were collected. Results: Recalled childhood PA levels were positively associated with adult antecedent cognitive appraisals, core affective exercise experiences, and overall attraction to exercise. MANOVA showed differences for antecedent appraisals, core affective experiences, and overall attraction to exercise based on levels of childhood PA and youth sport participation. Further, an interaction with gender on interest and competence appraisals emerged, with women who did not participate in organized sports during childhood reporting lower scores than other groups. Discussion: A relationship may exist between childhood PA or sport participation and reports of affective exercise experiences during adulthood. It is important that children be provided with early opportunities to associate PA with pleasure.

Longitudinal Relations Between Body Image Flexibility and Exercise Motivation: A Two Sample Replication Study

Karen Leung, Western University; Katarina Huellemann, Western University; Kelsey Sick, Western University; Eva Pila, Western University

Body image flexibility refers to a person's ability to accept and experience positive and negative thoughts and feelings about the body so they can engage in behaviours that are consistent with their values, such as exercise. Although body image flexibility is theorized to promote adaptive behavioural outcomes, little research has examined the relationship between body image flexibility and self-determined exercise motivation, a key predictor of exercise behaviour. Further, most research on body image flexibility and exercise motivation has employed cross-sectional designs and used trait-level measures, precluding an understanding of how these constructs fluctuate over time and within individuals. Thus, the purpose of this longitudinal research study was to examine prospective within- and between-person associations between body image flexibility and self-determined exercise motivation in two independent samples of young adults. Study 1, participants ($N = 189$, $M_{age} = 20.17$, $SD = 1.82$) completed weekly body image and exercise-related online surveys over a three-week period. Study 2 ($N = 191$, $M_{age} = 20.07$, $SD = 1.56$) was a direct replication of Study 1. Based on findings from separate multilevel models adjusting for age and sex, there was a positive association between body image flexibility and exercise motives such that when participants reported higher body image flexibility than usual, they reported more self-determined exercise motives (Study 1: $\gamma_{20} = 0.38$, 95% CI[0.01, 0.74]; Study 2: $\gamma_{20} = 1.00$, 95% CI[0.55, 1.43]). Between participants, higher average scores on body image flexibility were associated with higher exercise motives (Study 1: $\gamma_{01} = 1.37$, 95% CI[1.00, 1.73]; Study 2: $\gamma_{01} = 0.98$, 95% CI[0.53,1.45]). The present findings support the utility of body image flexibility in promoting adaptive exercise motives. Future research is needed to explicate the directional nature of these associations, and to test the extent to which experimentally inducing and cultivating higher levels of body image flexibility, may be associated with exercise motivation.

The Development and Articulation of National Mental Health Guidelines for Recreational Sports in Australia

Caitlin Liddelow, University of Wollongong; Jordan Sutcliffe, University of Wollongong; Matthew Schweickle, University of Wollongong; Christian Swann, Southern Cross University; Stewart Vella, University of Wollongong

This presentation will outline the process that was undertaken in writing national mental health guidelines for recreational sports in Australia, and give an overview of those guidelines. The guideline development process was grounded in established protocols for quality guideline development, including the Appraisal of Guidelines for Research and Evaluation instrument and the Grading of Recommendations, Assessment, Development and Evaluation framework. Furthermore, evidence was incorporated into the process through four foundational empirical studies. First, a systematic review of all mental health interventions in recreational sport was undertaken to ascertain the strength and quality of evidence-based interventions that are available. Second, a systematic review and meta-synthesis of all existing mental health position and consensus statements in sport was undertaken to provide a summary of existing approaches to mental health and wellbeing promotion in sport globally. Third, to incorporate end-user knowledge and preferences, and to facilitate stakeholder co-development of the guidelines, focus groups were undertaken with a purposive sample of key stakeholders and end-users. Finally, a Delphi study was undertaken to assess expert opinion on the content of national mental health guidelines for recreational sport in Australia. A guideline development committee was established to oversee the assessment and interpretation of evidence, and draft the guidelines. The guideline development committee included representatives from key stakeholders such as national sporting bodies, government organisations and stakeholder groups such as disability sports, as well as experts in mental health and sport. The final guidelines covered key areas including

coach training, administrative responsibilities of sport program providers, and responsibilities of governing bodies such as state and national sports organisations. We share this information with the intention of enabling others to follow a similar process in articulating national mental health guidelines in other countries. Funding source: Australian Research Council.

A Systematic Review of Sport Psychology Practitioners' Professional Development

Janaina Lima Fogaca, Long Beach State University; Alessandro Quartiroli, University of Wisconsin – La Crosse; University of Portsmouth; Julia Guevara, Long Beach State University; Christopher Wagstaff, University of Portsmouth

Sport psychology scholars have recently begun to dedicate attention to the exploration of the factors relating to the professional development (PD) of sport psychology practitioners (SPPs). The value of understanding how PD unfolds for SPPs lies in the potential for such knowledge to enhance educational and training programs and promote effective, competent, and ethical practice. Several authors have explored facets of the PD of SPPs using theoretical frameworks borrowed from counseling psychology, and this work has begun to illuminate how PD develops among SPPs. Nevertheless, given the dependence of early work on counseling psychology models and the emergence of a body of SPP-specific work, it appears timely to take stock of the existing knowledge on SPP PD. As such, in the present study, we aimed to systematically review the extant literature focused on PD to identify developmental characteristics specific to SPPs towards a more comprehensive approach to SPP PD that more fully acknowledges SPP nuance. Using PRISMA guidelines, our initial research database searches identified 1,147 research records, which were screened by title, resulting in 110 research records. These were then screened based on abstract against pre-determined inclusion criteria. Next, 42 full text articles were assessed for eligibility and assessed for quality, of which, 12 articles were excluded due to issues surrounding the variables studied and publication type. A thematic analysis of the final 30 papers led us to a critical exploration of the current knowledge of SPP PD, clarifying developmental processes and highlighting gaps in the literature. Understanding the developmental process of SPPs may help educational and training programs tailor their practices to their students' developmental needs. Moreover, in light of the predominant use of participants from a small collection of populations, we would encourage researchers to explore the appropriateness of these findings outside of Anglo-Saxon contexts and also explore the potential utility of assessment tools for monitoring the PD of SPPs.

Peer Health Coach Experiences With University Health Coaching and Motivational Interviewing

Janaina Lima Fogaca, Long Beach State University; Saemi Lee, California State University, Los Angeles; Courtney Joseph, Independent scholar; Dawn Clifford, Northern Arizona University; Natalie Papini, Northern Arizona University; Jonathan Lee, Northern Arizona University

Given the increased attention to the improvement of healthy lifestyles in America, many college campuses are providing supportive services and interventions in this regard for students. Peer-led health coaching is a realistic and sustainable way to support students' health behavior changes on college campuses. Motivational Interviewing (MI) has also proven to be an effective framework to guide behavior change conversations and can be of use in health coaching situations. However, research on the experiences of peer coaches who provide health coaching using MI are relatively scarce. Therefore, the purpose of this study was to examine the experiences of peer educators who use MI to provide health coaching services at a university. Participants were five peer health coaches from a mid-sized southwestern university who were interviewed about their experiences in training, implementation, and supervision. Interpretive Phenomenological Analysis (IPA) was used to analyze the interviews by two authors, while one other author audited the coding. We identified four main themes: (1) learning MI, (2) using MI, (3) challenges of time and availability, and (4) supervision and peer support. Results illustrated the developmental processes peer health coaches experience as they develop their MI skills. Aside from challenges in learning and using MI, supervision was an important factor that helped peer health coaches develop as practitioners. Training methods and supervision strategies that may support peer health coaches' development will be discussed. Future research should continue to investigate training methods and supervision strategies to improve the quality of peer health coach programs and their services.

The Use of Goal Setting to Promote Positive Health Outcomes in Youth With Disabilities: A Scoping Review

Franziska Loetzner, Wayne State University; Deborah Charbonneau, Wayne State University; Leah Ketcheson, Wayne State University

Background: Declining levels of physical activity throughout childhood is a growing concern. Goal setting theory uses motivation and purposeful decision making to improve performance in a targeted domain. Although there is ample empirical support demonstrating the benefits of physical activity (PA), sustained behavioral changes following intervention are difficult to achieve. Goal setting represents an attractive, however, there has been limited research in this rising field, so a scoping review is needed. Objective: To conduct a scoping review to identify the existing research on the use of goal setting theory to improve health and physical activity in youth. Methods: A literature search was conducted and Guided by the Joanna Briggs Institute framework for scoping reviews. Searches were conducted in four electronic data bases (PubMed, ERIC, CINHAL, ProQuest) to find peer reviewed articles in the English language published between 2011 and 2021. Characteristics of the studies were extracted using the PRISMA-ScR Group Guidelines for Preferred Reporting Items for Scoping Reviews. Results: Out of the 136 articles found, 5 met the inclusion criteria. The final review included 5 articles published over a 10 year period, and a total of 103 participants aged 6-22. All 5 reported the use of goal setting to enhance physical activity. Discussion: Goal setting represents an accessible and affordable option for the promotion of physical activity throughout childhood.

Exploring a Novel Model of Weight Stigma, Body Image, and Physical Activity in Adults

Kristen M. Lucibello, University of Toronto; Madison F. Vani, University of Toronto; Catherine M. Sabiston, University of Toronto

Experienced and internalized weight stigma are associated with i) negative body image, and ii) less physical activity (PA). Furthermore, negative body image relates to lower PA and positive body image relates to higher PA, suggesting body image is an untested mediator of the association between weight stigma and PA. However, weight stigma research is limited by its focus on negative body image, as opposed to the empirically-supported conceptualization of body image as multifaceted. There has also been minimal investigation into resistance training. Therefore, the purpose of the present study was to test a comprehensive model of the associations among weight stigma, positive and negative body image, and PA in adults. Adults ($N = 510$, $M_{age} \pm SD = 28.09 \pm 5.87$, 70.4% women) completed a cross-sectional online survey to assess weight stigma (experienced, internalized), body

image (body-related shame, embarrassment, and authentic pride, body appreciation) and PA (moderate-to-vigorous physical activity [MVPA] and resistance training). A path analysis was used to assess the proposed model. Experienced weight stigma was indirectly associated with resistance training ($\beta = -.039$, $p < .001$) and MVPA ($\beta = -.030$, $p = .002$) through higher internalized weight stigma and lower body-related authentic pride. While higher internalized weight stigma was also maladaptively associated with body-related shame ($\beta = .54$, $p < .001$), body-related embarrassment ($\beta = .48$, $p < .001$), and body appreciation ($\beta = -.44$, $p < .001$), mediating effects on physical activity were not found. These findings partially support our proposed model and underscore the importance of body-related authentic pride for physical activity promotion in individuals who have experienced and internalized weight stigma. Funding source: NASPSPA Graduate Student Research Grant.

Fire in the Belly: Psycho-Behavioural Factors Influence Athlete Development When Environmental Factors are Controlled

Clare MacMahon, La Trobe University; Juanita Weissensteiner, New South Wales Office of Sport; Elissa Morley, Australian Institute of Sport

In any talent identification and development program, some athletes progress, and others do not. We compared athletes from the kayaking Australian National Talent Identification (NTID) program to explore key factors. Six pairs of athletes (N = 12) were matched by age, gender, coach, and daily training environment. In each pair, one athlete represented Australia and progressed in the sport, and the other did not. Semi structured interviews were conducted with the athletes, as well as three NTID head coaches and one assistant coach. The interviews gathered data on the factors that facilitated and constrained successful talent development at different phases along the athlete development pathway. Two conceptual models were produced and aligned with the phases of athlete development (Gulbin et al., 2013), with one model for junior and one for senior athletes. The models show that when many of the environmental features of practice were controlled for through case-matching, the main factors influencing athlete development were predominantly psycho-behavioural. Among the influential factors identified were 'fire in the belly', perseverance, adaptability, a commitment to kayaking, and enjoyment, all of which were supported by auxiliary and associated factors and underpinned by ongoing progress. This presentation will discuss fire in the belly as a sport talent development concept that is related to, but distinct from those of grit (Duckworth & Gross, 2014) and passion (Vallerand, 2003). Competitiveness is a key defining feature of fire in the belly. In our data, fire in the belly was fueled by the Olympic dream in open age athletes, and by a desire to travel internationally with an Australian team in junior athletes. We suggest NTID programs include targeted efforts to stoke the fire in developing athletes for optimal results. Funding: Australian Research Council. Funding source: Australian Research Council Linkage Grant (LP100100324), Improving determinants of Australian sports talent identification and development: A multidisciplinary study.

Making the 'MOST' Out of Your mHealth Intervention: How to Develop Behaviour Change Interventions Using the Multiphase Optimization STrategy

Megan MacPherson, University of British Columbia; Kohle Merry, University of British Columbia; Sean Locke, Brock University; Mary Jung, The University of British Columbia

With thousands of health and fitness mHealth interventions on the market, people struggle to choose an appropriate intervention. The lack of evidence-based mHealth may be due to limited research on intervention development and continued use of traditional research methods for mHealth evaluation. The Multiphase Optimization Strategy (MOST) is a 3 phase development framework which highlights not only intervention effectiveness, but also affordability, scalability, and efficiency (EASE), all factors necessary to developing mHealth interventions that will be used in practice. MOST Phase I highlights the importance of formative intervention development, which is often overlooked and rarely published. MOST Phase I aims to identify candidate intervention components, create a conceptual model, and define an optimization objective; however, the framework does not provide robust guidance on how to conduct quality Phase I research: what steps can be taken to identify intervention components, develop the conceptual model, and achieve intervention EASE with the implementation context in mind. To advance the applicability of MOST within the field of behaviour change science, this work provides an exemplar for how to develop an mHealth intervention. Specifically, we provide an example of how to achieve MOST Phase I goals by outlining the formative development of a text messaging intervention within a diabetes prevention program. Based on these experiences, recommendations are proposed for future researchers to conduct formative research on mHealth interventions with implementation in mind. Given its considerable reach, mHealth has the potential to positively impact public health by decreasing implementation costs and improving accessibility. MOST is well-suited for the efficient development and optimization of mHealth interventions. By using an implementation-focused lens and outlining the steps in developing an mHealth intervention using MOST Phase I, this work can guide future intervention developers towards maximizing the impact of mHealth outside of the research laboratory.

Examining the Latent Structure and Reproducibility of the Life Skills Scale for Sport

Leapetswe Malete, Michigan State University; Chelsi Ricketts, Michigan State University; Sehee Kim, Michigan State University; Tshepang Tshube, University of Botswana; Thuso Mphela, University of Botswana; Clement Adamba, University of Ghana; Reginald Ocansey, University of Ghana

The growing interest in sport-based positive youth development programs across the African continent calls for the development or testing of measures to assess competencies that youth develop through sport participation. The Life Skills Scale for Sport was recently developed to assess sport-specific life skills. Despite its good psychometric properties among samples of British youth sport participants, only four known studies have conducted cross-cultural examination of the scale's psychometric properties. Given evidence of cross-cultural differences in the conceptualization of the eight factors measured by the LSSS, this study aimed to examine the latent structure and reproducibility of the LSSS among a sample of youth sport participants from Botswana and Ghana. Participants were 495 youth athletes (male = 51.72%), aged 12–21 years ($M = 16.76$, $SD = 1.58$), from junior and senior secondary schools. Confirmatory factor analysis and exploratory structural equation modeling were conducted, and conventional fit indices were used to assess model fit. In the current sample, results on the original LSSS model indicated the need for model re-specification. A re-specified LSSS, consisting of the original eight factors, but only 34 of the original 43 items, demonstrated improved fit and adequate internal consistency. The re-specified LSSS proved to be a valid and reliable measure for use with the current sample of youth sport participants. Therefore, researchers and practitioners may utilize this instrument to evaluate the effectiveness of sport programs in the imparting of life skills in the African youth sport context. Funding source: Alliance for African Partnerships.

Exploring the Relationship Between Use of Social Media Workouts, Exercise Motives, and Mental Health During the COVID-19 Pandemic

Sabrina Malouka, University of Toronto; Kristen Lucibello, University of Toronto; Lamia Firasta, University of Toronto; Catherine M. Sabiston, University of Toronto

With social media growing in popularity and COVID-19 restricting access to gym and exercise spaces, many have turned to social media for at-home workouts. Motivations for seeking at-home workouts include management of health, appearance, and mood, as well as socialization. While the importance of exercise motivation for exercise maintenance has been demonstrated, there is little understanding of how social media use for exercise, exercise motivation and mental health are linked. The current study examined the associations between using social media workouts, motivation for using social media workouts, and mental health. Participants ($N = 300$; 65% women, $M_{age} \pm SD = 23.60 \pm 3.57$) completed self-report questionnaires to assess engagement in social media workouts, motivation for engagement in social media workouts, and depression and anxiety symptoms. Based on the results, the majority (61%) of the sample reported using social media workouts at least once a week. No differences in mental health were found between those who use versus do not use workouts on social media [$F(2, 297) = .14$, $p = .87$]. Among those who use social media workouts, higher depressive symptoms were associated with higher appearance motives for social media workouts [$F(1, 182) = 5.45$, $p = .021$]. Higher anxiety symptoms were also associated with higher appearance motives [$F(1, 182) = 7.75$, $p = .006$] and social motives [$F(1, 182) = 4.83$, $p = .029$] for social media workouts. Motives did not mediate the association between depression [95% CI = -.27, .30] or anxiety symptoms [95% CI = -.40, .18] and days of social media workout use per week. These results highlight the link between anxiety and depression symptoms and appearance motives specifically. Implications of the results for exercise maintenance and body image will be discussed.

Trait Resiliency, Physical Activity, and Biological Sex Contribute Differently to Psychological and Physiological Measures of Stress

Maryam Marashi, McMaster University; Jennifer J. Heisz, McMaster University

The COVID-19 pandemic is linked with higher-than-normal levels of anxiety and depression. Despite experiencing similar stressors, not everyone has been equally affected, and therefore, it is important to identify key protective factors. One protective factor may be resiliency — defined as the ability to adapt flexibly to a changing, or challenging, environment. Another is physical activity. Resiliency and physical activity are both associated with a healthy cardiovascular response to stressors as indexed by higher heart rate variability (HRV), which begs the question: how uniquely related are resiliency and physical activity when it comes to one's susceptibility to mental illness? To answer this question, we recruited 61 participants aged 22 to 46 years old, all graduate students whose research was directly impacted by the COVID-19 pandemic. Regression analyses were conducted to examine the independent contribution of resiliency and physical activity to anxiety, depression, and HRV while controlling for the change in stress brought on by the pandemic. Participants who reported more pandemic-related stress were more anxious ($\beta = .59$, $p < .001$, $f^2 = .50$) and depressed ($\beta = .46$, $p < .001$, $f^2 = .23$). While controlling for change in stress brought on by the pandemic, participants with higher resiliency, especially in the domain of "purpose", were less anxious ($\beta = -.33$, $p = .003$, $f^2 = .09$). Similarly, participants with higher resiliency, especially in the domains of "purpose" and "existential aloneness" were less depressed ($\beta = -.51$, $p < .001$, $f^2 = .25$). Participants who engaged in more moderate-intensity physical activity were less anxious activity ($\beta = -.24$, $p = .03$, $f^2 = .04$), which accounted for unique variance not accounted for by resiliency. HRV was higher (i.e., more favorable) in males than females ($\beta = -.43$, $p = .002$, $f^2 = .18$), suggesting a potential sex difference in vulnerability to stress-induced mental illness. Funding source: NSERC, SSHRC.

The Effects of a School-Based Recess Intervention on Recess Quality, Bullying, and Exclusion

William Massey, Oregon State University; Janelle Thalken, Oregon State University; Isabella Sciuto Ozenbaugh, Oregon State University; Deanna Perez, Oregon State University; Maya Trajkovski, Oregon State University

While research has supported that school-based recess can facilitate social, cognitive, and academic benefits for children (Murray et al., 2013), other evidence documents high levels of conflict, fighting, and bullying (Massey et al., 2017). Recent data has suggested that recess quality is connected to positive developmental outcomes in children (Massey et al., 2021). The purpose of the study was to examine if a recess intervention aimed at increasing recess quality would decrease student-reported levels of victimization and exclusion at recess. Baseline data collection, which included recess observations using the Great Recess Framework-Observational Tool (GRF-OT) and a recess experiences survey that measured perceptions of victimization and exclusion during recess, was completed fall of 2019. The GRF-OT was then used as an intervention framework, with the study team conducting school staff trainings on recess facilitation; developing a student recess committee that helped determine shared rules and expectations for recess; shifting power to students to decide what would be available for use at recess; providing resources to secure play equipment for the school; increasing overall options for various types of play during recess; and working with staff to improve transitions to and from recess. While the intervention was planned to last the entire school year, we re-collected data after 6-weeks as that was the conclusion of the staff training period. End of year data collection was not possible due to school closures as a result of the COVID-19 pandemic. GRF-OT scores showed an increase in overall recess quality ($M = 42.13_{PRE}$; $M = 51.63_{POST}$). Reported bullying and exclusion on the playground were reduced based on one's race (12.7% to 6.1%;); academics (12.5% to 9.1%); religion (14.1% to 7.6%); socioeconomic status (14.1% to 7.7%); first language (7.8% to 4.5%); and interests (23.4% to 18.2%). Implications and future directions for this line of research are discussed.

Moving Together: Municipal, Community, and Academic Partner Perspectives on Physical Activity and Social Inclusion Among Older Adults

Meghan H. McDonough, University of Calgary; Michelle Patterson, University of Calgary; Jennifer Hewson, University of Calgary; Ann Toohey, University of Calgary; Stephanie Won, City of Calgary; Sian Jones, City of Calgary; Raynell McDonough, City of Calgary; Ari Agha, City of Calgary; Chantelle Zimmer, University of Calgary; William Bridel, University of Calgary; Sarah Kenny, University of Calgary; Cari Din, University of Calgary

Municipal, health, and community organizations promote physically active recreation for older adults because such programs can address social and physical needs. However, promoting sustained physical activity and reducing social isolation are challenging. Providing group physical activity programming is a potential platform for addressing these needs concurrently, but does not ensure that older adults will attend, or that supportive relationships will form. This study identified priorities and issues in promoting

physical activity and social inclusion in group programming for older adults from the perspective of stakeholders working with municipal, health, and community organizations. Using interpretive description methodology, focus groups were held with stakeholders ($N = 29$) from our municipality ($n = 12$) and from 16 community and health organizations ($n = 17$). Audio recordings, field notes, and participant notes were analyzed to identify (1) social outcomes valued by the participants' organizations, and both barriers and promising practices for achieving them; and (2) challenges of providing and evaluating age-friendly programming. Promoting role models of active aging; increasing social networks and social participation; creating accepting, welcoming, and inclusive environments; facilitating connection, community, and belonging; and fostering social support were valued. Barriers included the difficulty of reaching socially isolated older adults, challenges entering activities in unfamiliar places with established social groups, and lack of information on meeting older adults' social needs. Promising practices included strategies for engaging, connecting with, and retaining older adults in programs. Challenges for providing and evaluating age-friendly programming included disseminating information, collaborating across organizations, lack of accessible spaces, and the need for methods to assess social outcomes. Findings identified social outcomes prioritized by organizations and areas where future research can inform promising practices and program evaluation. Funding source: Canadian Institutes for Health Research.

Fixing a "Broken System": An Exploration of Coaches' and Health Care Providers' Experiences of Working With Pregnant and Postpartum Elite Athletes

Tara-Leigh McHugh, University of Alberta; Autumn Nesdoly, University of Alberta; Lauren Ray, University of Alberta; Jane Thornton, Western University; Rshmi Khurana, University of Alberta; Margie Davenport, University of Alberta

The voices of pregnant and postpartum elite athletes, along with their coaches and health care providers, are underrepresented in the sport literature. Recent research that is grounded in the experiences of elite athletes has shed light on the complex challenges of navigating sport environments that do not support or value pregnant and postpartum athletes. Understanding the experiences of coaches and health care providers is also necessary for the development of evidence-informed policy and practices to support athletes. This qualitative description study describes coaches' and health care providers' experiences of working with pregnant and postpartum elite athletes. Sixteen participants (4 coaches, 12 health care providers), who have worked with pregnant and/or postpartum elite athletes within the last five years, participated in this research. Thirteen of the participants self-identified as women, and three as men. Data were generated via semi-structured one-on-one interviews that were audio-recorded, transcribed verbatim, and analyzed through a process of content analysis. The findings of this research are represented by five main themes: (a) Female athlete research, (b) Evidence-informed education and training, (c) Evidence-based progression for sport participation in pregnancy/postpartum, (d) Athlete-centered care, and (e) Essential supports and changes required for gender equity in sport. Findings from this research, which are grounded in the unique perspectives of coaches and health care providers, outline specific recommendations and policy suggestions that are necessary for supporting pregnant and postpartum elite athletes. Funding source: Social Sciences and Humanities Research Council (SSHRC).

The Coach-Athlete Relationship From the Coaches' Perspective: A PRISMA Systematic Literature Review

Keith McShan, Wayne State University; E. Whitney G. Moore, Wayne State University

The purpose of this study was to systematically review the variables associated with the coach-athlete relationship (CAR) from the coaches' perspective. The coach-athlete relationship was examined at the full scale and subscale level. Three databases were searched; 57 studies published between January 2000- May 2021 met the inclusion criteria. These published studies used quantitative, qualitative, or mixed methods approaches. Combined, these studies had 8,348 coach participants from over 20 countries. Coaches were both men and women; they coached individual and team sports from the youth to the international level. Correlates ($n = 35$) were grouped into three categories: coach variables, athlete variables, and coaching behaviors. Satisfaction was the most researched variable related to the CAR from the coaches' perspective. Variables positively associated with the coaches' perceptions of the CAR included harmonious passion, coaching efficacy, the teaching of life skills, athlete satisfaction, and engaging in need supportive behaviors. Whereas negative correlates included neuroticism of the coach, coaching burnout, athletes' avoidant attachment style, coaches' avoidant attachment style, and coaches' controlling behaviors. Aside from coach satisfaction, many of the relationships noted above came from only one or two studies; therefore, replication studies are needed with the CAR from the coaches' perspective to understand the consistency of the relationships with these correlates. Furthermore, research examining correlates associations with the CAR from the perspectives of coaches who are female, volunteer, and/or train adolescents and youth is needed, as initial findings suggest these may all be moderators of the CAR quality. In conclusion, coaches who create an environment that is caring, autonomy-supportive, and teach life skills seem more likely to develop high-quality coach-athlete relationships, and so also more likely to be satisfied with their coaching experience.

Hardiness in First Year AROTC Cadets: A Mixed Methods Approach

Monaye Merritt, Auburn University; Danielle Wadsworth, Auburn University

In military personnel high hardiness is linked to reducing ill-effects of stress, health maintenance, and better performance (Meredith et al., 2011), but is rarely evaluated over time and unexamined in Reserve Officer Training Corps (ROTC). This study assessed changes in hardiness three times over one year and determined the impact on performance in first year ROTC cadets. Performance was measured via Army Combat Fitness Test (ACFT) taken twice per semester. The ACFT is a series of six events reflecting the physical stress of a combat environment. Through a mixed methods design, survey data was collected in August, January, and April to examine hardiness. Qualitative data consisted of interviews and self-assessments. Cadets ($N = 37$, 89% Caucasian, 70% male) completed the Hardiness Resilience Gauge (Bartone, 2018) at each time point. Changes in hardiness were analyzed through a repeated measures ANOVA. Hierarchal linear regression models evaluated the influence of demographics (biological sex, military dependent status, in/out–state resident status, and scholarship status) and hardiness on the ACFT. Qualitative data explored cadet's conceptualization of their first-year experience concerning stress, training, and performance. Data sets were combined to form meta-inferences. No significant changes in hardiness occurred from August to April ($F_{1,18} = .806$, $p = .381$, $\eta^2 = .043$). Two regression models predicting performance in August were significant, $R^2 = .784$, $p < .001$, and $R^2 = .791$, $p = .002$. Biological sex was the only significant variable in models 1 and 2 ($p < .001$). Through qualitative data cadets described their year as a learning curve embodying a true first year experience with three emerging themes: *Getting Here*, *I Know Nothing*, and *Being Better*. Hardiness did not change, nor played a significant role in performance. Through mixed methods, cadets shared latent qualities of hardiness

development within the qualitative data undetected by survey. Future studies should continue to examine the development of hardiness from early training to soldier status.

The Effects of Acute Exercise on Stress Reactivity in Adults: A Systematic Review

Anisa Morava, Western University; Kirsten Dillon, Western University; Wuyou Sui, University of Victoria; Erind Alushaj, Western University; Harry Prapavessis, Western University

Psychological stress is associated with widespread effects on human health. Growing evidence suggests acute exercise may be a viable way to reduce stress reactivity. One prior review and meta-analysis demonstrated that acute aerobic exercise reliably reduced blood pressure responses to psychological stress. The present review examined the role of acute exercise, of any modality, on stress reactivity using a multidimensional approach via heart rate, blood pressure, cortisol, catecholamine, and self-report measures. A systematic search of five databases in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines was conducted in March 2021. Search terms related to stress reactivity, stress-inducing tasks, and acute exercise were used. The inclusion criteria was as follows: participants aged ≥ 18, used an acute exercise intervention, employed a validated stress task, assessed stress reactivity, and published in English. Twenty-five studies were included. Acute exercise resulted in consistent and robust reductions to blood pressure and cortisol measures of reactivity. The effects of acute exercise on heart rate reactivity were mixed and the limited number of studies precluded conclusions regarding acute exercise and catecholamine reactivity. Most studies detected negligible effects between acute exercise and self-report reactivity. Acute exercise reduces stress reactivity, specifically blood pressure and cortisol responses. Future work should standardize definitions of stress reactivity and recovery, while also better defining assessment time points to promote the synthesis of results. We also recommend exploring the interplay between physiological and psychological responses to acute exercise and stress, particularly in real world contexts.

Stakeholders' Experiences Supporting Physical Activity for Older Adults

Lindsay Morrison, University of Calgary; Meghan H. McDonough, University of Calgary; Monica Franco, University of Calgary; Jennifer Hewson, University of Calgary; Ann Toohey, University of Calgary; Cari Din, University of Calgary; Peter Crocker, Unversity of British Columbia

Group physical activities can facilitate healthy aging through social and physical participation. Social support can promote older adults' engagement in physical activity; however, knowledge gaps exist regarding specific supportive behaviours that programs can provide or facilitate to engage older adults and support healthy aging. This study explored service provider perspectives about providing and supporting physical activity for older adults, specifically social support needs, barriers, and practice considerations. Using interpretive description methodology, semi-structured interviews were conducted with six professionals engaged in practice related to older adult physical activity (two recreation specialists, two social workers, and two individuals working in community organizations supporting older adult physical activity). Two themes were identified related to providing and supporting physical activity: building trust and relationships with older adults and advocating for and creating physical and social activity opportunities. Three themes were identified related to barriers: health conditions, lifestyle behaviours, and resistance to being active. Multi-level considerations included policy (prioritizing older adult physical activities and collaboration among organizations); program (equitable access for people of diverse backgrounds and abilities, consistent program delivery, and providing programs of varying intensities and types); and the physical environment (accessibility). These findings indicate the need for organizations to share expertise and suggest that supportive programming could focus on building relationships, acknowledging individual factors, developing inclusive resources, prioritising accessibility, and listening to older adult suggestions to provide older adults with accessible physical activity opportunities responsive to their needs. Funding source: Social Sciences and Humanities Research Council of Canada.

The Adult-Oriented Sport Coaching Survey Demonstrates Configural, Metric and Scalar Invariance in Athletes' Responses

Derrik Motz, University of Ottawa; Scott Rathwell, University of Lethbridge; Bradley W. Young, University of Ottawa; Bettina Callary, Cape Breton University

The Adult-Oriented Sport Coaching Survey (AOSCS; Rathwell et al., 2020) provides researchers with a self-report tool to measure the frequency of use of adult-oriented coaching practices. Studies involving the AOSCS have reported several types of validity and reliability (Motz et al., in press; Rathwell et al., 2020), yet the psychometric invariance of the instrument remains untested. This study aimed to test factor- and item-level invariance of athletes' responses on the AOSCS to determine whether the measured constructs are interpreted similarly across athlete groups. Responses from 616 Masters athletes were considered as a function of age (35-55 years-old; 56-85 years-old), gender (male; female), highest competitive level (international-national level; recreational-regional-provincial level), and sport type (swimming; other sports, including athletics, skiing, and 13 others) groupings, with all groupings having $n > 231$. Four distinct confirmatory factor analyses (CFA) tested the configural invariance, respectively, applying CFI > .9, RMSEA < .06, SRMR < .08 criteria of fit (Tabachnick & Fidell, 2019). CFI (≥ -.01), RMSEA (≥ .015), and SRMR (≥ .03) difference tests (Chen, 2009) were used to test metric and scalar invariance in comparison to each configural model. Configural invariance (i.e., adequate model fit; all CFI > .901, RMSEA < .077, SRMR < .051) was achieved as a function of age, gender, highest competition level, and sport type. Difference tests showed evidence for metric (ΔCFI ≥ -.003, ΔRMSEA ≤ -.002, ΔSRMR ≤ .008) and scalar invariance (ΔCFI ≥ -.009, ΔRMSEA ≤ -.002, ΔSRMR ≤ .012) for all category groupings. The findings provide further evidence for the validity of the athlete version of the AOSCS (i.e., AOSCS-A) by demonstrating the instrument is interpreted similarly across research groupings pertinent athletes' experiences in coached Masters sport contexts. Additional invariance testing is needed with alternative grouping variables and future projects should investigate invariance testing using the coach-report version of the AOSCS. Funding source: SSHRC Insight Grant #227348.

Primary Outcomes of the Cognitive Regulation Training and Exercise (CORTEX)-II Trial: Effects on Physical Activity Engagement

Sean Mullen, University of Illinois at Urbana-Champaign; Sa Shen, University of Illinois at Urbana-Champaign; Madhura Phansikar, University of Illinois at Urbana-Champaign; Adam Taggart, University of Illinois at Urbana-Champaign; D. David Thomas, University of Illinois at Urbana-Champaign; Maxime Lussier, Université de Montréal; Arthur Kramer, Northeastern University; Edward McAuley, University of Illinois at Urbana-Champaign

The purpose of this randomized controlled trial was to test the effectiveness of a multimodal cognitive training program for increasing physical activity engagement among middle-aged adults. Low-active adults ($N = 233$;

M_{age}=46.7) predominantly non-Hispanic (92.3%), White (81.1%), female (65.6%) with a college degree (74.7%) were recruited to participate in a 13-month study. Participants completed a battery of assessments (psychosocial, neuropsychological, & physical functioning) at baseline and subsequently were randomly assigned to receive 20 hours of cognitive training via *Games* (stationary computerized tasks emphasizing executive functioning and exerciser self-certainty, and exergaming with dual-task components; $n = 118$) or attention-control health educational *Videos* ($n = 115$). Training was split across five 2-hr lab sessions (overall adherence=98.3%), followed by five 2-hr home sessions. Among Games, 81.4% fully complied with our exergaming protocol (lab & home) and 88.4% completed the cognitive training protocol. Video engagement was assessed via accuracy to attentional checks (82% in lab & home). The primary outcome was physical activity engagement (PAE), a latent factor based on physical activity steps & moderate intensity minutes derived from yearlong Fitbit step recordings, visitations & self-report). As hypothesized, Bayesian multiple-indicator, multiple-cause model analysis indicated a significant group effect (PAE score $M\pm SD$ is 4.20±1.02 in Games and 3.77±0.92 in Videos; Cohen's $d = 0.19$, $p = 0.03$) after adjusting for a set of background variables. Based on 58.4% respondents to our study evaluation survey, 87.3% enjoyed their assigned intervention; 97.1% would recommend it. Only 4.1% of study completers guessed the study's true purpose. Results associated with hypothesized mechanisms of behavior change, including cognitive functioning and psychosocial outcomes, will be discussed. Our findings replicated our previous trial, and show reliable effects for promoting exercise engagement within an unsupervised community-based exercise program for middle-aged adults. Funding source: National Institute on Aging.

Psychometrics of the Self-Efficacy for Exercise Memory Questionnaire (SEEM-Q) and Associations With Self-Efficacy Beliefs for Exercise and Memory

Sean Mullen, University of Illinois at Urbana-Champaign; Madhura Phansikar, University of Illinois at Urbana-Champaign; Adam Taggart, University of Illinois at Urbana-Champaign; D. David Thomas, University of Illinois at Urbana-Champaign; Arthur Kramer, Northeastern University; Edward McAuley, University of Illinois at Urbana-Champaign

Memory functioning has been associated with physical activity engagement across the lifespan. Domain-specific memory may be even more critical for sustained engagement, such as remembering public health recommendations, how to properly perform movements or modifications, and when and how to evaluate progress. In the absence of an assessment of exercise-specific memory functioning, a self-efficacy for exercise memory-questionnaire (SEEM-Q) was developed and assessed at baseline and one-month follow-up, in the context of an exercise trial ($N = 233$ middle-aged adults, 65.6% women). The purpose of this study was to assess the SEEM-Q's psychometrics and explore domain-specificity of exercise memory beliefs and functioning. Covariance modeling was conducted using *Mplus 8.6*. A hierarchical structure with three exercise memory self-efficacy factors (AERO, STREN, & FLEX) fit the data ($\chi^2 = 20.55$ (df = 15), p =.152; CFI = .996, RMSEA = .040; λs =.80 -.95) with good model-based reliability (ω^2 = .91-.95) and temporal invariance (CFIΔ = .001). Expected correlation patterns with 95% confidence intervals were found among all composite scores with established measures of self-efficacy. Specifically, positive correlations were found with self-efficacy to adhere to exercise and overcome barriers to exercise, and confidence in one's spatial memory ability (via Memory Self-Efficacy Questionnaire) and preventing memory decline (subscales of the Memory Controllability Index [MCI]), but not with present memory ability (via MCI subscale or Frequency of Forgetting) or generic memory preservation strategies (via Metamemory Questionnaire). Interestingly, AERO, STREN, and FLEX were associated with faster reaction time performance (even after adjusting for known covariates), but not with working memory performance via Sternberg task. Findings offer initial evidence for the SEEM-Q's psychometric properties. Future research is needed to elucidate the factors that influence confidence in one's memory about exercise, and the relationship between generic and domain-specific memory beliefs and functioning. Funding source: National Institute on Aging.

Partnering Women Diagnosed With Breast Cancer: Associations Between Daily Social Support and Exercise Across 3 Weeks

Ross M. Murray, University of Toronto; Jenna Smith-Turchyn, McMaster University; Angela J. Fong, Rutgers University; Meghan H. McDonough, University of Calgary; Daniel Santa-Mina, University of Toronto; Kelly Arbour-Nicitopoulos, University of Toronto; Linda Trinh, University of Toronto; Jennifer M. Jones, University Health Network; Jackie L. Bender, University Health Network; Nicole Culos-Reed, University of Calgary; Jennifer R. Tomasone, Queens University; Madison F. Vani, University of Toronto; Catherine M. Sabiston, University of Toronto

One in eight Canadian women will be diagnosed with breast cancer, and 5-year survival rates are up to 87%. However, breast cancer survivors perceive a steep drop-off of services and support after primary treatment, when navigating the persistent and latent effects of cancer care are needed most. Exercise is a well-tested, non-pharmacological strategy that improves health and wellbeing through breast cancer survivorship; social support has been found to facilitate exercise in breast cancer survivors. Individuals interpret the quality and quantity of social support more favorably when they share a common identity (e.g., surviving breast cancer). However, support strategies for BCS typically partner Survivors with a trained coach or health care provider. A limitation of this strategy is that partners are less likely to share a common identity which can underpin support processes. This ecological momentary assessment (EMA) study examined naturally occurring social support as related to daily exercise behavior. Forty-six breast cancer survivors were paired using evidence-based criteria and followed over 21 days while providing daily social support surveys and Fitbit devices to measure exercise. Mixed models revealed that higher levels of daily social support were linked to more daily steps and more minutes of high intensity exercise; with no significant association with changes in light intensity exercise. Moderation analysis indicated that breast cancer survivors who reported less social support before the study had a stronger association between daily social support during the study and more minutes of high intensity exercise. Based on these results, peer matching programs that increase social support among breast cancer survivors (simply by pairing women who share the identity) might be effective in encouraging more exercise at health-enhancing levels, especially among women who perceive they have lower levels of social support. Further research is needed to develop systematic strategies aimed at improving social support among breast cancer survivors. Funding source: Canadian Cancer Society.

Mechanisms by Which Fun for Wellness May Promote Subjective Well-Being in Adults With Obesity: A Reanalysis Using Baseline Target Moderation

Nicholas D. Myers, Michigan State University; Isaac Prilleltensky, University of Miami; Adam McMahon, University of Miami; Ahnalee M. Brincks, Michigan State University; Seungmin Lee, Binghamton University; Ora Prilleltensky, University of Miami; Karin A. Pfeiffer, Michigan State University; André G. Bateman, Michigan State University

Fun For Wellness (FFW) is a self-efficacy theory-based online behavioral intervention that aims to promote growth in physical activity and well-

being. The FFW conceptual model for the promotion of subjective well-being posits that FFW exerts both a positive direct effect, and a positive indirect effect through well-being self-efficacy, on subjective well-being. Subjective well-being is defined in FFW as an individual's satisfaction with their status in seven key domains of their life. Well-being self-efficacy is defined in FFW as the degree to which an individual perceives that they have the capability to attain a positive status in seven key domains of their life. The objective of this study was to use baseline target moderation to assess variation in the impact of FFW on subjective well-being dimensions in adults with obesity. Data (N = 667) from the Well-Being and Physical Activity Study (*ClinicalTrials.gov, identifier: NCT03194854*) were reanalyzed. There was evidence that well-being self-efficacy at baseline moderated the direct effect of FFW on well-being self-efficacy at 30 days post-baseline for the occupational and psychological dimensions. Each of these two findings suggests a "compensatory" effect. Similarly, there was evidence that well-being self-efficacy at baseline moderated the indirect effect of FFW on subjective well-being at 60 days post-baseline through well-being self-efficacy at 30 days post-baseline for the occupational and psychological dimensions. Each of these two findings suggest a "compensatory" effect. Finally, there was evidence that well-being self-efficacy at baseline moderated the direct effect of FFW on subjective well-being at 60 days post-baseline for the community, occupational, and physical dimensions. Each of these three findings suggests some version of a "rich-get-richer" effect. In summary, results provide both supportive and unsupportive (i.e., interpersonal, economic, and overall dimensions) evidence regarding variation in the impact of the FFW intervention and should impact the design of future FFW trials. Funding source: Funding for the study was provided by both the Erwin and Barbara Mautner Charitable Foundation through the Erwin and Barbara Mautner Endowed Chair in Community Well-Being at the University of Miami (Isaac Prilleltensky) and the National Institute on Drug Abuse (NIDA) grant # K01 DA046516 (Ahnalee Brincks, Principal Investigator).

Investigating Post-Secondary Student Occupational Functioning and Mental Health Recovery Following Physical Activity Intervention

Amy Nesbitt, University of Toronto; Melissa deJonge, University of Toronto; Emily Nalder, University of Toronto; Catherine Sabiston, University of Toronto

While there is strong evidence illustrating the benefits of physical activity (PA) for post-secondary student mental health (MH), whether these effects extend to students' occupational functioning (OF) (e.g., one's ability to engage in meaningful daily activities) is not yet well understood. Using a one group pre-test post-test design among students seeking MH support at a Canadian university ($N = 50$; $M_{age} = 24.5 \pm 4.64$ years), the present study aimed to examine: (1) the effects of a 6-week PA intervention on student OF and MH recovery, and (2) whether the relationship between PA and MH recovery is different for students who experience greater change in OF. Main study variables were assessed at baseline and post-intervention using the Sheehan Disability Scale and the Canadian Personal Recovery Outcome Measure. Data were analyzed using paired sample t-tests and simple moderation analysis to address each objective. Positive changes were observed across all three OF domains, including school/work (mean change = -1.36, $p < .001$, $d = 0.53$), social life/leisure activities (mean change = -1.96, $p < .001$, $d = 0.60$), and family/household responsibilities (mean change = -0.96, $p = .032$, $d = 0.31$), as well as students' global OF (mean change = -4.28, $p < .001$, $d = 0.55$) and MH recovery (mean change = 2.48, $p < .001$, $d = 0.55$). Additionally, a significant moderation effect was found ($p < .05$), whereby greater change in global OF increased the strength of the relationship between change in students' PA behaviour and MH recovery. These findings suggest that PA programs are a valuable approach for supporting student MH, and that targeting improvements in OF may be important for enhancing personal recovery processes among students with MH concerns. More research is needed to explore whether these effects endure over time and potential mechanisms linking PA to both functional and recovery-oriented outcomes.

Demographic and Medical Correlates of Changes in Sedentary Behaviour Among Cancer Survivors During the COVID-19 Pandemic

Alyssa R. Neville, University of Toronto; Allyson Tabaczynski, University of Toronto; Linda Trinh, University of Toronto

Emerging evidence suggests that greater sedentary time (SED), independent of physical activity, is associated with an increased risk of cancer mortality. SED has increased among healthy adults during the COVID-19 pandemic; however, it remains unknown which factors may have influenced changes in SED among cancer survivors. The purpose of this study was to examine the demographic, medical, and clinical correlates of changes in cancer survivors' SED during the pandemic. A global sample of cancer survivors completed an online cross-sectional survey. Demographic (e.g., age), medical (e.g., smoking history), and clinical (e.g., cancer status) variables, as well as daily SED before and during the pandemic via the Domain-Specific Sedentary Questionnaire were collected via self-report. Participants were categorized into three groups: those who increased SED by a meaningful magnitude (>30 minutes) (35.1%), those who reduced SED by >30 minutes (35.8%), and those who did not change SED by a meaningful magnitude (change <±30 minutes) (29.1%). Multinomial logistic regressions were conducted to determine the correlates of changes in SED among the three groups. Cancer survivors ($N = 385$; $M_{age} = 48.2 \pm 15.5$) were predominantly female (69.4%), White (90.9%), and had a mean months since diagnosis of 91.5±84.2. Compared to survivors who did not change SED, those who increased SED by >30 minutes were significantly more likely to be employed (OR = 1.79; $p = .03$) or be a regular or social drinker (OR = 1.84; $p = .05$). Compared to survivors who reduced SED by >30 minutes, those who did not change SED were significantly more likely to avoid alcohol (OR = 2.31; $p = .009$). Given the shift to remote work during the pandemic, there is a need for tailored interventions in the workplace aimed at increasing light physical activity and reducing SED, as well as messaging regarding maintaining a healthy lifestyle. Funding source: University of Toronto COVID-19 Student Engagement Award.

Family Distress and Physical Activity in Children and Youth With Disabilities: The Moderating Role of Parent Online Resource Use During the Pandemic

Roxy Helliker O'Rourke, University of Toronto; Maeghan E. James, University of Toronto; Sarah A. Moore, Dalhousie University; Kathleen A. Martin Ginis, University of British Columbia; Kelly P. Arbour-Nicitopoulos, University of Toronto

COVID-19 has negatively impacted children and youth with disabilities' (CYWD) access to physical activity (PA). Lack of access to the PA that CYWD engaged in prior to the pandemic may perpetuate family distress for parents of CYWD. The primary aim of this study was to examine the family distress and child PA relationship during the initial (May 2020) period of COVID-19 in parents of CYWD. Given that coping strategies may mitigate family distress and physical inactivity, and the increased availability of online PA resources for supporting parents during the pandemic, a secondary aim was to test the moderating role of parents' use of online PA resources on the distress-child PA relationship. 147 parents [$M_{age} = 42.4$ ($SD = 5.74$),

92.1% women; child: M_{age} = 10.77 (SD = 3.22), 74.2% boys, 36.4% with a developmental or physical disability] reported on family distress levels (0 = none to 10 = extreme), their use of online PA resources (yes/no), and their child's moderate-to-vigorous PA [MVPA] (0 or ≥1 day/wk of 60+ minutes MVPA), as part of a larger study on child movement and parent support behaviours during COVID-19 in Canadian CYWD. Logistic regression analyses were run using PROCESS macro to test the moderating effect of parent's use of online PA resources on the family distress-child MVPA relationship with child age as a covariate. Parents reported their child engaged in a mean of 60+ minutes of MVPA for 1.6 days/wk, and a moderate level (4.57) of familial distress. Most (70.5%) parents reported not using online PA resources. The family distress-child MVPA relationship was not significant (r = -0.017, p > .05). Parents' use of online PA resources had a small but significant conditional effect on child MVPA in parents with moderate family distress (log odds=.91, 95%CI [0.13,1.69]). Results show concerning levels of distress among families of CYWD and a lack of uptake of online PA resources in parents of CWYD. Further research may explore preferred PA resources of parents of CYWD, and strategies to mitigate family distress during COVID recovery efforts. Funding source: Canadian Tire Jumpstart Charities, SSHRC.

Attending to Attention: How Declines in Physical Activity Levels and Mental Health Impacted Attention During the Onset the COVID-19

Michelle Ogrodnik, McMaster University; Maryam Marashi, University of Toronto; Jennifer Heisz, McMaster University

Since the onset of the SARS-CoV-2 pandemic, people have experienced significant changes in their physical activity levels and mental wellness—importantly, they have also experienced shifts in their attention and focus. Using survey data from 1669 Canadians (collected between April 23 to June 30, 2020), Kruskal-Wallis tests with Dunn's multiple comparisons was used to compare self-reported attention according to changes in mental health and physical activity since the onset of the pandemic. Significant differences in attention scores were related to self-reported changes in mental health since the onset of the pandemic ($H(5) = 269.5$, p >0.001), with a large effect (η^2 =.196). Overall, participants who had poorer mental health also reported poorer attention. Attention scores were also significantly different between self-reported exercise status since the onset of the pandemic ($H(5) = 87.937$, $p > 0.001$), with a small to medium effect (η^2 = .065). Participants who endorsed a completely sedentary lifestyle had significantly worse attention than those who identified as moderately active, very active, or as a recreational athlete. When comparing moderately active versus very active, those who were more active had better self-reported levels of attention. The results have important implications for the workplace. While many work and educational settings continue to expect pre-pandemic productivity levels, employees' cognitive capacity—specifically focused attention—may not be operating at pre-pandemic levels, particularly for those who are experiencing worse mental health or engaging in less physical activity.

Operationalizing the RE-AIM Framework for a Physical Activity Coaching Program for Adults With Spinal Cord Injuries

Kenedy Olsen, University of British Columbia; Kathleen A. Martin Ginis, University of British Columbia; Sarah Lawrason, University of British Columbia; Cath LeCornu Levett, VCH; Kristen Walden, Praxis Spinal Cord Institute; Christopher B. McBride, SCI BC; Jasmin K. Ma, University of British Columbia

Individuals with spinal cord injuries (SCI) typically participate in less physical activity (PA) than the able-bodied population. In the SCI population, PA often peaks during inpatient rehabilitation and declines upon discharge due to many barriers present in the community. The purpose of this study was to evaluate the effectiveness and sustainability of a PA coaching program delivered by physiotherapists and SCI peers during the transition from in-hospital care to community-living using the RE-AIM (reach, effectiveness, adoption, implementation, maintenance) framework. Six individuals (M_{age} = 52.3) were recruited and received weekly PA coaching sessions from physiotherapists in-hospital and a SCI peer when in community. The intervention was guided by the Health Action Process Approach model. Results demonstrated that the program reached 59.2% of inpatients at the participating hospital. Effectiveness was assessed via data extracted from semi-structured interviews conducted 6-months post-discharge, and surveys administered throughout the duration of the intervention, which showed overall positive feelings associated with the intervention. Aerobic PA levels were maintained from discharge (M = 76.4 min/wk) to 6-months post-discharge (M = 79.6 min/wk, p > 0.05). Strength training significantly increased from discharge (M = 16.0 min/wk) to 6 months post-discharge (M = 85.6 min/wk, p < 0.05). 15 physiotherapists and SCI peer coaches were trained on administering PA coaching sessions. 100.0% of recruited coaches adopted the intervention into their daily practice as assessed by questionnaires and clinical-client discussion lists. Measures of maintenance of PA behaviour demonstrated that 80.0% of participants remained physically active for the entirety of the intervention. Results of this study demonstrated the valuable impact of transitional PA coaching on improving and maintaining PA behaviour in individuals with SCI to prevent declines in PA at discharge, and the importance of using program evaluation tools when implementing interventions in healthcare and community settings.

Peer Relationships and Social Media Use

Olufemi Oluyedun, Hope College; Julia Dawson, Hope College

Peers play a vital role in shaping athletes' sporting experiences (Smith, 2019). Recent descriptive work has explored the importance of peers in sport by examining friendship quality and relevant motivation constructs (Weiss & Smith, 2002). More recently, the emergence and prevalence of social media has provided researchers with a unique context to explore. Limited work has examined the influence of social media in sport. The primary purpose of this study was to provide a descriptive account of social media use (frequency) and satisfaction among youth sport soccer athletes. A secondary purpose was to examine social media use and satisfaction as predictors of sport friendship quality dimensions (positive friendship quality and friendship conflict). Youth athletes (N = 163; M_{age} = 15.51 years; 73.6% male) provided demographic information, completed an established measure of friendship quality, and reported on frequency and satisfaction of social media. Descriptive data suggest Texting, Instagram, and Snapchat were the top used mediums for communication. Positive friendship quality shared a positive association with Texting and Snapchat use. Friendship conflict shared a positive relationship with Instagram and Snapchat use. No social media medium shared a significant relationship with social media satisfaction. Multivariate multiple regression analysis showed greater use and satisfaction of Texting, Instagram and Snapchat to predict stronger friendship quality dimensions. This study helps add to the existing literature base by showing how social interactions that take place outside of the typical sport setting may play a role in shaping athletes sporting experiences. Funding source: Nyenhuis Collaborative Research Grant.

Triathletes' Retrospective Accounts of Past Clutch Performances: A Mixed-Methods Study

Mark P Otten, California State University, Northridge; Jessica Lewis, California State University, Northridge; Bruno Gamboa, California State

University, Northridge; Micaela Enriquez, California State University, Northridge; Isabel López, University of California, Santa Barbara

In recent years, sport psychology studies of being "clutch" – that is, giving a positive response to a pressure situation – have begun to gain traction. The current study aimed to advance our understanding of the psychological underpinnings of clutch performance by two new quantitative athlete assessments, as well as a qualitative inquiry. A sample of 398 triathletes of a variety of backgrounds were recruited and asked to complete these online. They were first asked to identify a past clutch performance, and then fill out the Intuitive Control Inventory and the Competitive State Anxiety Inventory-Positive (CSAI-P), as well as the widely published Competitive State Anxiety Inventory-2 (CSAI-2R), all retrospectively. That is, the athletes were asked to recall how they felt just before, and during, their chosen performance. Following a set of factor analyses, revealed were a moderate positive correlation between the intuitive control and positive anxiety factors ($r = .163$, $p = .001$), and a negative relationship between traditional anxiety (by the CSAI-2R) and control ($r = -.337$, $p < .001$). A surprising positive correlation between positive anxiety and traditional anxiety was also seen ($r = .411$, $p < .001$). Thus, we suggest that conventional state anxiety (e.g., concern) may still benefit a clutch performance if accompanied by other, positive feelings (e.g., excitement). Qualitative responses revealed that athletes who reported the highest levels of control and/or positive anxiety frequently credited their extensive mental and physical preparation for success. Those who felt the least control and/or positive anxiety more often mentioned pride just in completing the race, while those reporting moderate levels of control/anxiety were most likely to focus on the outcome of the performance event. Taken together, the current data provides a large-scale, detailed, firsthand look at what a clutch performance feels like for a high-level athlete. Practitioners, coaches and athletes may draw on these findings to capture, or train for, future success under pressure conditions.

A Study of the Application of Wearable Devices to the Physical Fitness and Psychological Skills Training Program for Taekwondo Athletes

Jihae Park, Korea National Sport University; Duksun Chang, Korea National Sport University

The goal of this study is two folds: to develop a program for training physical and psychological skills using wearable devices for Taekwondo athletes and to test its effect on the physical strength and psychological skills. To this end, we recruited 10 university Taekwondo athletes (*Mage* = 20.50±0.67); five of them were assigned to the experimental group and participated in 18 sets of the training program developed based on Kim et al. (2011) for 6 weeks, whereas the other five were assigned to the control group. Using a triangulation approach for data collection, we measured the participants' physical strength consisting of 7 sub-factors—i.e., muscle strength, muscle endurance, cardiovascular endurance, quickness, agility, flexibility, and equilibrium—and psychological skills at three time periods (pre-test, post-test, follow-up test), conducted interviews with them, and collected their activity data. Our ANOVA analyses on the physical strength showed a significant group-by-time period interaction effect in muscle endurance ($F = 4.393$, $p = .030$), while there was only a significant effect of time period in cardiovascular endurance ($F = 4.062$, $p = .037$) and agility ($F = 10.148$, $p = .001$). The ANOVA analyses on psychological skills also revealed a significant group-by-time period interaction ($F = 3.754$, $p = .046$); a follow-up analysis on the sub-factors of psychological skills showed a significant effect of time period on goal setting ($F = 4.837$, $p = .023$). For the wearable device, the experimental group perceived the fact that it indicates the exercise intensity and recovery speed as its advantage but the fact that the exercise strength is exposed to others as its disadvantage. Importantly, our analysis showed the negative experiences in physical training influence psychological skills training, and that psychological skills training, which in turn exerted a positive influence on their mind control, concentration improvement, goal setting, willpower, motivation, and confidence. Taken together, the current finding is expected to contribute to improving the Taekwondo training programs.

Effect of a Virtual Service-Learning Physical Activity Program on Kinesiology Students' Attitudes Toward People With Disabilities

Junghoon Park, California State University, Northridge; Furtado Ovande, California State University, Northridge; Jongmin Lee, California State University, Northridge; Jessica Harrison, California State University, Northridge; Taeyou Jung, California State University, Northridge; Mai Narasaki-Jara, California State Polytechnic University

Service-learning programs have been documented to be effective for college students to develop positive attitudes toward people with disabilities. Such positive attitudes are particularly important for Kinesiology major students as they are trained to become future health and fitness professionals. Due to COVID-19 pandemic disruption, most in-person service-learning programs were transformed into virtual platforms. The present study investigated the effect of a 10-week virtual service-learning program on Kinesiology major students' attitudes toward people with disabilities (ATPD). A total of 50 Kinesiology undergraduate students participated in this intervention study. Subgroups were created based on the students' previous experiences in working with individuals with disabilities. Each participant assisted community members with disabilities in 50-minute therapeutic exercise sessions under clinical supervision. The virtual service-learning exercise program was held via a video conference platform (Zoom, 2021) twice a week for 10 weeks. Changes in students' attitudes toward people with disabilities were measured by using the Attitudes Toward Disabled Persons Scale (ATDP) (Yuker, 1966), which was administered online before and after the 10-week service-learning program. A paired t-test revealed no significant difference in ATDP scores over the 10 weeks. In addition, subgroup analyses showed no group x time interaction between the two subgroups over 10-week intervention. These results indicate that virtual service-learning programs may not significantly affect students' attitudes toward individuals with disabilities, which is inconsistent with reported outcomes from in-person service-learning studies. Also, our findings in the subgroup analyses revealed that previous experience in working with people with disabilities does not seem to impact the attitudes. Further studies would help us acquire a better understanding of our outcomes by comparing the effects of virtual versus in-person service-learning programs on changes in attitudes toward people with disabilities.

The Role of Secondary Control for Athletes During Setbacks for Fostering Motivation and Wellbeing

Patti C. Parker, University of Alberta; Lia M. Daniels, University of Alberta; Amber D. Mosewich, University of Alberta

To date, empirical evidence on the function of secondary control (SC) beliefs (e.g., adjusting the self to the environment) in sport is lacking. Previous control research shows SC in health and achievement settings can be adaptive for individuals facing setbacks when primary control (PC; e.g., acting on the environment) is limited. Our study objective examined the impact of athletes' perceptions of control (PC and SC) on important psychosocial outcomes. Using a cross-sectional design, postsecondary competitive athletes from the USA and Canada who indicated experiencing a past setback ($N = 129$; $M_{age} = 20.89$ years, 67% women, 77% currently playing a competitive sport) responded to an online Prolific survey. We tested the interaction effects of athletes' SC and PC beliefs—when reflecting about a past setback (e.g., interruption to sport)—on

setback-related anxiety, rumination, and positive and negative affect. When competitive athletes' PC beliefs were low, their SC beliefs were related to lower setback-related anxiety about being perceived weak (B = -.13, p = .015), experiencing pain (B = -.16, p = .005), letting others down (B = -.12, p = .014), and losing support (B = -.20, p = .004). When their PC beliefs were high, SC beliefs were associated with lower anxiety about the setback reoccurring (B = -.11, p = .005), as well as lower rumination (B = -.12, p = .008). Further, SC beliefs were associated with lower negative affect (B = -.19, p = .027) regardless of PC levels, but had no relationship with positive affect in sport. Our findings reveal SC may serve an adaptive function for various setback-related anxiety outcomes, particularly when PC is low, as well as help to attenuate negative affect and harmful rumination. The implications of the findings are important in light of the many setbacks experienced in athletes' careers and the rising reported levels of mental health problems in sport. Promoting SC beliefs through possible control-enhancing interventions are a direction for future research. Funding: SSHRC. Funding source: SSHRC.

Does It Matter When the Setback Happened? Assessing Differences in Perceived Setback Severity, Achievement Motivation, and Emotions in Sport

Patti C. Parker, University of Alberta; Gabrielle N. Pelletier, University of Alberta; Lia M. Daniels, University of Alberta; Amber D. Mosewich, University of Alberta

Whether engaging in sport at the elite or recreational level, setback experiences in sport are inevitable and can be detrimental for motivation. Furthermore, across the globe, sport setbacks are particularly critical to study in light of the COVID-19 pandemic interrupting athletes' sport seasons. The study objective was to compare the motivational and emotional responses of athletes reflecting on a setback they had experienced (or were presently experiencing). Thus, our study comprised two groups: 130 athletes with a past setback and 68 athletes with a current setback. North American athletes (M_{age} = 20.88, 72% women, 26% men, 2% non-binary) in postsecondary settings responded to online survey questions pertaining to the experience of a sport setback (e.g., past or current, severity, COVID-19 context), achievement goals in sport, setback-related emotions, and demographic information. Of our sample, 144 athletes reported they were currently playing a competitive sport, and 54 were not. Independent sample t-tests revealed that compared to athletes who had experienced a past setback, athletes currently experiencing a setback indicated greater guilt (t = 2.42, p = .017), shame (t = 2.78, p = .006), and perceptions of setback severity (t = 3.10, p = .002). Concerning achievement motivation, these athletes also reported lower task approach goals (t = -2.48, p = .015) than their counterparts who had experienced a past setback. Finally, of the 68 currently experiencing a setback, 25% indicated their setback was related to COVID-19 (e.g., gym closures, fear of COVID-19, loss of motivation/effort) and many of the non-related COVID-19 setbacks were sport injuries. These findings are timely, illuminating the potentially harmful effects of experiencing setbacks "in the moment" on athletes' motivation and mental health. More research is warranted to investigate whether encouraging athletes to reflect on resolved setbacks can help them stay motivated and combat negative affect and perceptions of setback severity. Funding source: SSHRC.

"I'm Going to Change the WiFi Password If You Don't Go Outside": A Temporal Exploration of the Pandemic's Impact on Parenting Practices

Derek Paterson, University of British Columbia; Mark Beauchamp, University of British Columbia; Louise Mâsse, University of British Columbia; Guy Faulkner, University of British Columbia

Parenting practices, which reflect goal-oriented strategies used by parents to influence behavior, are instrumental in shaping the physical activity (PA) and screen-based sedentary behaviors of children. However, parenting behaviors must be understood within the contexts in which they occur. The COVID-19 pandemic provided an opportunity to understand the changing nature of parenting practices in the context of complex changes within and beyond the family unit. The aim of this study was to explore the temporal effects of the pandemic on parenting practices over the first 18 months. Semi-structured interviews were conducted with 40 parents of children aged 7-11, evenly distributed across three provinces in Canada: Ontario, British Columbia and Nova Scotia. A narrative thematic analysis was conducted to construct themes across cases while organizing and contextualizing the temporal sequence of events. Changes in parenting were characterized by several themes. Initial opportunities for structured PA disappeared as a result of pandemic restrictions and once relaxed, many parents opted not to immediately re-facilitate structured PA and increase allowance of unsupervised outdoor PA, while others rebounded quickly. Adaptation was seen in many cases through changes in nondirective support (parents co-participating and modelling PA), expectations, equipment provision, autonomy support (encouragement, discussing benefits), coercive control and rewards although the extent and temporal pattern of adaptation was varied. Leniency in enforcement of rules for screen usage was common alongside greater family sedentary time and screen availability. Trajectories for recovery of parenting practices over time were variable and context-dependent. While PA parenting practices rebounded more elastically, a reduced capacity to regulate screen-based behaviors exhibited more permanence. This is likely an important target for future family-based intervention. Funding source: N/A.

VE Design to Study Pre-Competitive Emotions in Sports Using the Virtual Environment Design and Underlying Mechanisms (VEDUM) Framework

Hannah Pauly, University of Muenster; Sebastian Harenberg, St. Francis Xavier University; Charlotte Raue-Behlau, University of Muenster; Svenja Anna Wolf, Florida State University

Pre-competitive emotions can have facilitative or debilitative performance consequences (Wolf et al., 2015). Studying pre-competitive emotions with the help of virtual environments (VE) allows the design of environmental conditions that may intentionally trigger similar reactions compared to real world (Gray, 2017). Many factors (e.g., design, responses) must be considered when designing an effective VE. Despite the gaining popularity of VEs, there is an absence of evidence-based guidance about the VE design decisions. Recently, Harenberg and colleagues (2021) proposed the VEDUM framework to fill this gap in the literature. The aim of this presentation is to illustrate the decisions of VE design to study precompetitive emotions using the VEDUM framework. In detail, the VEDUM framework is based upon Herbelin's (2002) stimuli-organism-reaction chain of presence and divides VE experiences into the four phases: 1) design (e.g., perspective), 2) perception (e.g., presence), 3) response (e.g., emotional), and 4) outcomes (e.g., learning). Furthermore, the method of visualization (e.g., head-mounted display), user factors (e.g., exposure to VEs), external factors (e.g., outside noise) and interventions outside of the VE (e.g., anxiety management) can moderate/mediate the perception and response phases to the VE's outcomes. To elicit pre-competitive emotions, the realism of the VE is important. Hence, 360° video may be more usable than a simulated environment. This choice may influence the perception of the environment (e.g., immersion), the task (e.g., task similarity) and the "self" (e.g., presence). A VE experience focusing on pre-competitive emotions may be combined with structured interventions (e.g., arousal management). Finally, the virtual experience may facilitate a potential learning transfer to competitions. Limitations of the VEDUM framework and future research directions will be discussed.

Child-Based Solutions to Improve Recess: A Qualitative Focus Group Exploration

Deanna Perez, Oregon State University; Janelle K. Thalken, Oregon State University; Isabella Ozenbaugh, Oregon State University; Maya Trajkovski, Oregon State University; William V. Massey, Oregon State University

School recess provides an important opportunity for child development, as it is generally the only unstructured time during the school day where children can focus on play, fun, and socialization. Children have valuable perspectives of recess, which could be used to facilitate recess implementation. However, previous research shows that adults have significantly more power in decision making processes around recess than children (Massey et al., 2019). This study aimed to explore children's perceptions of recess and their recommendations for improving recess in an effort to translate findings into practical solutions within schools. A total of 89 students, in grades two through five, participated in 17 focus groups that were centered on children's perceptions of recess. Students came from four public elementary schools in three rural school districts in the Pacific Northwest that serve mostly White and Latinx families in low-to-middle income brackets. Following data collection, a content analysis was conducted. Two themes were developed that highlighted important areas of dissonance. First, while recess was coded as a place of socialization, this included both positive (i.e., friendships) and negative (i.e., bullying, exclusion) socializing influences. Second, while children discussed a need for rules and rule enforcement at recess, they often did not understand the reasoning behind rules and recognized different adults enforced varying rules. To help alleviate these areas of dissonance, children made recommendations for improvements at recess. These included more access to recess (i.e., more frequent and longer recess periods); more inclusive and nontraditional activities like drawing and board games at recess; boundaries between areas of the playground; and students having a voice in shaping the rules that govern recess, along with consistent adult implementation of those rules. Overall findings suggest that children are aware of both the problems and solutions relating to recess, and their perspectives can provide valuable insight during intervention planning.

Feasibility and Impact of a Remote Flow-Based, Moderate-Intensity Yoga Intervention on Executive Functioning, During a Pandemic, Among Working Adults

Madhura Phansikar, University of Illinois Urbana-Champaign; Neha Gothe, University of Illinois Urbana-Champaign; Rosalba Hernandez, University of Illinois Urbana-Champaign; Sandraluz Lara-Cinisomo, University of Illinois Urbana-Champaign; Sean P Mullen, University of Illinois Urbana-Champaign

Low-intensity yoga benefits cognitive function but less is known about the effects of flow-based moderate-intensity forms of yoga on cognitive functioning. There is growing consensus among researchers for the need to exploring the effects of different yoga styles and components. The SUNRAE study was designed to test the feasibility and initial efficacy of an 8-week flow-based, moderate-intensity yoga intervention (3x/week, 50 mins) to improve cognitive functioning with sequences of postures and guided breathing exercises (vs. a waitlist control arm). This randomized controlled trial included 86 full-time working adults (81.40% female; *M*age=41 years, $n = 43$ in each group) with symptoms of stress. Supervision was titrated from remote individual and group instructional sessions to self-guided video sessions. Feasibility was assessed via adherence (verified via Fitbit activity and post-session logs), enjoyment, and adverse events. Executive functioning was assessed via forward and backward digit span, Stroop task, and a task-switching paradigm at baseline and post-intervention. A repeated-measures analysis of covariance, accounting for baseline scores, education, fitness and physical activity, prior yoga and exercise experience, and outcome expectancies was conducted. Overall attendance was 75.10% (supervised = 97.15% vs. self-guided = 63.50%), 100% of participants enjoyed the intervention, and there was one adverse event. The yoga group had higher accuracy on digit span forward and backward ($Ms \pm SD = 7.30 \pm 3.05$ vs. 6.11 ± 2.70) after accounting for covariates; other improvements did not reach statistical significance. Mediation analysis revealed that change in perceived stress from baseline to mid-point of the intervention partially mediated the effect of the intervention on backward digit span ($\beta = .203$, SE = .112, $p = .034$). These results suggest that regular flow-based yoga at moderate intensity may improve working memory, in part through stress reduction. Remote flow-based yoga practice may be safe, enjoyable, and increase accessibility to yoga and its health benefits. Funding source: NASPSPA Graduate Student Research Grant.

Examining the Impact of Resilience-Based Programming for First-Year Collegiate Student-Athletes

Scott Pierce, Illinois State University; Eric Martin, Boise State University; Kelly Rossetto, Boise State University; Liam O'Neil, Utah State University

The transition to college brings many challenges for student-athletes, yet also presents the opportunity for growth and development. Student-athletes can benefit from proactive, strengths-based resilience programming to support self-esteem and satisfaction. This study examined the impact of a resilience-based educational program on student-athlete' psychological adjustment and functioning. In total, 135 first-year student-athletes (73 female; 62 male) at two NCAA Division I universities completed programming in their first semester of college. In addition, 56 first-year students completed surveys as a control group. Measures assessed anxiety and depression, perceived stress, satisfaction with life, resilience, and athletic identity (student-athletes only) at three time points (pre-program, post-program, end of semester). Descriptive statistics revealed that student-athletes showed positive markers of mental health across all three time points. Repeated measures ANOVAs revealed significant time and group interaction effects in perceived distress ($p < .001$) and life satisfaction ($p < .001$) and a main effect for stress ($p < .001$). The control group experienced an increase in distress at T2 while student-athletes did not experience changes in their distress, life satisfaction increased significantly from T2 to T3 for student-athletes only, while stress increased at T2 for both groups. Resilience scores did not change across the course of the semester ($p > .05$). In the student-athlete group, total athletic identity did not change ($p > .05$), but social identity increased ($p < .001$) and exclusivity decreased significantly ($p < .001$) during the semester. These findings suggest that the negative aspects of athletic identity can be modified without decreasing the importance of the athlete role. While results indicated a positive impact of the educational program, resilience training alone was found to be an incomplete intervention. In the future, environmental factors require scientific and practical consideration as part of such programming. Funding source: NCAA Innovations Grant.

(Re)imagining Youth Sport: Stakeholders Views of the Impact of COVID-19 on the Future of Youth Sport

Scott Pierce, Illinois State University; Liam O'Neil, Utah State University; Alysha Matthews, Michigan State University; Meredith Wekesser, Michigan State University; Emily Wright, College of Saint Benedict, Saint John's University; Jill Kochanek, Springfield College; Adam Kelly, Birmingham City University; Jennifer Turnnidge, Queens University; Karl Erickson, York University

The COVID-19 pandemic significantly changed how youth sport operated and adult stakeholders (i.e., administrators, coaches, and parents) were required to pause or adapt their approach to create alternative opportunities for participation. This study investigated youth sport stakeholders' perspectives of the impact of COVID-19 on youth sport and the implications of COVID-19 for the future. A total of 254 participants included youth sport parents ($n = 130$), coaches ($n = 94$), and administrators ($n = 30$) from 10 countries. The study used a mixed-methods research approach, with a sequential explanatory QUANT-QUAL design via a Qualtrics survey. Participants varied in the degree to which they were "re-imagining" youth sports, with 117 reporting that the removal of organized youth sport during the pandemic served only to reinforce how they previously viewed and valued youth sports, and 137 reporting that they used it as an opportunity for re-examination of what they wanted from youth sports. All stakeholders wanted a shift in priorities from pre- to post-pandemic. Ratings for winning as a youth sport priority significantly decreased ($p < .001$) from pre-pandemic views to hopes for the future. In contrast, ratings for healthy and fun experiences ($p < .001$), developing life skills ($p < .001$), making friends ($p < .001$), and community building, service, and contribution ($p < .001$) all significantly increased. While consistent in priorities, a bi-modal distribution emerged of participants ratings of the likelihood of their desired vision being realized. Subsequent qualitative analyses revealed that *optimists* believed that the pandemic had allowed for a productive re-imagining of youth sport and belief that stakeholders would work collaboratively toward a focus on holistic youth development. *Pessimists* believed that there was little chance of their vision becoming reality in the face of entrenched structures and competing priorities. Findings will be discussed in relation to the COM-B framework to examine how stakeholders' views and behaviors might be shaped in the future.

Decision Making of Referees in Blocked View Situations: Do Player Vocalizations Result in More Yellow Cards?

Alexandra Pizzera, German Sport University Cologne; Heiko Lex, University of Rostock

Referees in sport often need to make decisions in split seconds with limited information. For instance, a one-on-one situation in soccer on which the view is partly blocked, represents such a difficult situation for referees. According to the lens model approach by Brunswik (1952) such social judgments on distal events are usually based on sets of observable (proximal) cues. Previous research has shown that referees use proximal cues such as crowd noise, or vocalizations of players (e.g., crying out as if in pain) to judge whether a foul has been committed or to judge the severity of the foul (Lex et al., 2014). The aim of the current study was to examine whether referees compensate a blocked visual cue by using auditory cues, in this case players' vocalizations. Soccer referees ($N = 71$, $M_{age} = 31.06$ years, $M_{refereeing\ experience} = 14.21$ years) were asked to judge 40 randomly presented potential foul situations with low and high noise (crying out of the player potentially being fouled) regarding rule violations and foul severity. The videos represented scenes in which the referees had a free view on the situation or the view was partly blocked, e.g. by other players. The results revealed more no foul and foul decisions without sanctions in the low vs loud noise condition, as shown by a significant Decision x Sound interaction, $F(2.36, 165.20) = 4.74$, $p < .01$, $\eta^2 = .06$. Furthermore, the referees decided more often on no fouls and less often on yellow cards in the blocked view compared to the free view condition, $F(2.14, 150) = 47.17$, $p < .01$, $\eta^2 = .40$. Although more yellow cards were awarded in the bad view and loud noise condition whereas there was no difference in yellow cards between high and low noise in the free view condition, the Decision x Sound x View interaction was not significant, $F(2.44, 170.70) = 2.33$, $p = .089$, $\eta^2 = .03$. Referees seem to use the vocalizations of players for their decisions, and adapt their decisions to the viewing perspective they have in that decisions on foul severity are stricter if the referees have a clear view onto the scene.

Evaluation of a Sport for Development Program: The Case of the Pour 3 Points Organization in Montreal

Lara Pomerleau-Fontaine, Université de Sherbrooke; William R. Falcão, Concordia University

Sport for development (SFD) programs are a valuable and effective way for promoting the positive impacts of sports as a tool for personal and social development. The main objective of SFD programs is to encourage the use of sport, physical activity, and/or play to develop personal abilities and life skills for people in underserved communities. Despite their relevance, there is a lack of theory-based evaluation protocols to guide systematic SFD program evaluations, which hinders our understanding of their impact and their development. The purpose of the study was to develop and implement a theory-based evaluation program that met the goals of a SFD program and assess their impact among undeserved communities. The case used in this study was the Pour 3 Points (P3P) organization in Montreal, Canada. They offer a training program to teach coaches from schools in underserved communities the use of sport as a tool for development to foster personal and professional success of youth. As such, an evaluation program was developed to explore the experiences of both coaches and the athletic directors regarding the P3P training and to assess its impact on the coaches, athletic directors, and the overall school context. A mixed-method approach was used. Coaches ($N = 21$) completed five online surveys throughout the seasons describing their learning experiences during the training. Athletic directors ($N = 4$) participated in semi-structured interviews that examined their perceptions of the program, as well as its impact on coaches and the school. Data were analysed using thematic analyses. The results demonstrated the positive impacts of the program on coaches' attitudes towards sport as a tool for development. The athletic directors shared positive perceptions of the impact the P3P program had on coaches, despite noticing limited influence on the school context. This presentation addresses the theoretical foundations and creation of the evaluation program using the P3P organization as an example. The lessons learned provide recommendations for SFD practitioners and evaluators. Funding source: Mitacs.

Exploring the Relationships Between Sedentary Behaviour and Physical, Psychological, and Social Wellbeing Among Older Adults During COVID-19 Pandemic

Paige Pope, University of Lethbridge; Liam Collins, University of Lethbridge; Alex Engel, University of Lethbridge; Juan De La Rosa, University of Lethbridge

COVID-19 has undoubtedly impacted the behaviours, health, and well-being of all segments of the population, with the older adult population particularly at risk. Increased sedentary time, decrease activity levels, reduced psychology health and wellbeing, and limitations to social engagement are among some of the more prevalent concerns. The purpose of the present study was to investigate the relationship between sedentary behaviour, affect, and various indices of physical, social, and emotional health, alongside age, gender, and level of education. It was hypothesized that older adults that sit more would be more likely to experience lower indices of satisfaction with life, positive affect, and physical, social, and emotional health. 195 older adults (107 women; 85 men), who averaged 69.2 (SD = 4.2) years of age and ranged considerable in terms of highest level of education, completed an online survey. The survey including a demographics section, as well as the Positive and Negative Affect Schedule (20 items), Satisfaction with Life Scale (5 items), Medical Outcomes Survey Short Form 36-item (36 items), and the

Measure of Older Adults' Sedentary Time (14 items). Results demonstrated that sedentary time was significantly and negatively associated with general health ($p \leq .05$), energy ($p \leq .01$), physical functioning ($p \leq .05$), and satisfaction with life ($p \leq .05$). Although age, gender, nor level of education were significantly related to sedentary behaviour, these demographic variables were associated with indices of subjective well-being, as well as social and emotional health. While the study findings supported assertions between sedentary behaviour with indices of general health, physical health, and satisfaction with life, this trend was not reported with social and emotional health, nor positive affect.

24-Hour Movement Guideline Adherence and Mental Health: A Cross-Sectional Study of Emerging Adults With Chronic Health Conditions and Disabilities

Carah Porter, The University of Texas at San Antonio; Patrick McPhee, McMaster University; Matthew Kwan, Brock University; Brian Timmons, Brock University; Denver Brown, The University of Texas at San Antonio

Recent work has demonstrated beneficial associations between adherence to the Canadian 24-hour Movement Guidelines for Adults and mental health for post-secondary students. Emerging adults attending post-secondary education, however, are known to experience higher rates of poor mental health and these effects are exacerbated for emerging adults with chronic health conditions and disabilities (EAWD). The potential for movement behaviors to alleviate the mental health toll experienced by EAWD during their education is unknown. The purpose of this study was to examine associations between 24-hour movement guideline adherence and mental health among EAWD enrolled at post-secondary institutions. This cross-sectional study used data from the first cycle of the Canadian Campus Wellbeing Survey. A total of 6,077 EAWD aged 18 to 29 years (Mean age = 21.71 ± 2.90; 71.5% female, 25.3% male, 3.2% other) completed measures to assess adherence to the physical activity, recreational screen time, sitting time and sleep guidelines as well as indicators of psychological distress and mental wellbeing. Average treatment effect on the treated (ATT) was computed using multilevel regression models with double-robust covariate balancing propensity score weighting to adequately balance guideline adherers and non-adherers across confounding variables. Findings showed that adherence to the physical activity (ATT = -0.69; ATT = 1.69), recreational screen time (ATT = -0.50; ATT = 0.70), sitting time (ATT = -1.07; ATT = 1.76), and sleep (ATT = -1.44; ATT = 1.26) guidelines were each independently significantly associated with (all ps < .001) more favorable scores for psychological distress and mental wellbeing, respectively. Concurrent adherence to all four guidelines was associated with significantly lower psychological distress (ATT = -1.92, $p < .001$) and higher mental wellbeing scores (ATT = 2.68, $p < .001$). Collectively, these findings highlight the beneficial impact of 24-hour movement guideline adherence as it relates to mental health among EAWD while attending post-secondary education.

Exploring the Impact of Physical Activity on College Students' Stress and Academic Performance During the COVID-19 Pandemic

Sara Powell, California State University, Monterey Bay; Kimberly Fasczewski, Appalachian State University; Andrew Smith, Missouri State University

College student mental health has become a key area of concern in recent years. Stress can negatively impact the academic performance and quality of life of college students. One way to combat the negative effects of stress on college students is engagement in regular physical activity (PA). Further, it has been suggested that regular physical activity can increase concentration and attentional skills, which are linked to academic success. Therefore, the purpose of this study was to examine the effects of physical activity participation on college student stress and academic performance during the novel COVID-19 pandemic. Cross-sectional surveys were collected from college students at a midsize Midwestern university. Survey measures included the Perceived Stress Scale, the Godin Leisure-Time Exercise questionnaire, demographic questions, and questions pertaining to changes of stress levels and exercise habits since the COVID-19 pandemic began. A total of 357 college students (22.2 ± 6.1 yrs; 76.2% female; 90.2% white) completed the survey. Results indicated that 80.6% of students were experiencing high levels of stress at the time of the survey. Further, 53.2% of students rated their degree program as very or moderately stressful, while 42% of students indicated handling that stress moderately to extremely well. The majority of the sample (61.7%) were classified as regularly physically active, with 29.9% indicating they have been regularly exercising for six months or more. Data regarding changes in physical activity habits relative to COVID-19 indicated that 38.1% of students decreased PA, 22.4% increased PA, and 4.7% have not changed their PA habits. Overall, college students in this sample experienced high levels of stress, and roughly two thirds remain sufficiently inactive. This information may be used to promote regular PA as a means to manage stress among college students at mid sized universities.

Yoga is a Double-Edged Sword for Women With Gynecologic Cancer: Reflections on Body Image and Relations With Others Using Online Journal Writing

Jenson Price, University of Ottawa; Jennifer Brunet, University of Ottawa

Women with gynecologic cancer report long-term sequalae that can affect their body image and relations with others, leading to reduced quality of life. Yoga may help women let go of body-related self-judgement and preoccupations, and focus on personally meaningful things (e.g., relations with others). Further, yoga can be practiced by women of different ages with varying abilities. We conducted a qualitative study to explore how women with gynecologic cancer see yoga shaping their body image and relations with others. Women with gynecologic cancer ($N = 15$; M_{age}=50.1 ±13.5 years; M_{timedx}=2.9±3.1 years) actively practicing yoga completed a 30-day online journal following an event-based response protocol. After practicing yoga, participants responded to open-ended prompts on: (1) general feelings before and after, (2) body-related thoughts and feelings before and after, and (3) interactions with their partner (if any) and others. Deductive thematic analysis helped identify four themes: (1) *yoga helped women let go of denigrating self-perceptions and focus on their strengths*, (2) *falling short of expectations fostered reproachful self-perceptions*, (3) *an open mindset free of expectations buffers against reproachful self-perceptions while giving rise to gratitude and pride*, and (4) *self-perceptions during yoga are mirrored during intimate and platonic interactions*. Findings suggest commonly reported benefits of yoga (e.g., self-acceptance, relaxation) may depend on women's mindsets before and during yoga as well as their self-perceptions after yoga. In addition, yoga practices that foster self-acceptance and appreciation can benefit women's relations with others by helping them interact with others in an open, self-assured manner. However, yoga practices that foster self-criticism lead women to interact with others in a self-conscious manner. Online journals played a critical role in understanding women's lived experiences to gain in-depth, intimate insight into their real-time interpretations of yoga and its role in shaping their body image and relations with others.

Understanding Embodied Choices: How We Choose and Act: An Empirical Research Program of the Mind in Action

Markus Raab, German Sport University Cologne; Lisa Musculus, German Sport University Cologne; Jannis Freidrich, German Sport

University Cologne; Patricia Grove, German Sport University Cologne; Nils Heinrich, German Sport University Cologne; Sandra Ittlinger, German Sport University Cologne; Lisa Koop, German Sport University Cologne; Alexej Michirev, German Sport University Cologne; Simone Sparascio, German Sport University Cologne; Laura Voigt, German Sport University Cologne

Human performance requires choosing what to do and how to do it. Recently this has been coined embodied choices (Raab, 2017). In a research program we will provide a theoretical notion of what 'embodied' and 'choice' means in studies of embodied choices. In a study we present how the interaction between motor and cognitive planning in climbing can be understood. In this study, we tested how climbing-specific embodied planning developed from childhood to adulthood ($N = 104$, 6-32 y.o.a). Regression analyses revealed that embodied planning became more efficient between 6-8 years of age indicated by fewer holds used and faster route completion, but did not change during later adolescence, or adulthood. In addition, the combination of reaching kinematics to the next hold and long-term planning will be compared in conditions that have different requirements to cognitive or motor planning. Finally, we could show when limiting the reach of the arms that both cognitive and motor planning are adapted. Beyond the specific results obtained, we discuss how to set up a systematic research program for embodied choices that supports our understanding theoretically and methodologically. Funding source: German Research Foundation.

Experimental Test of a Weight Stigma Induction on Psychological Stress and Exercise

Isabella Randall, Western University; Eva Pila, Western University

Experienced weight stigma is robustly associated with deleterious physical and psychological health outcomes, particularly among higher-weight women. Weight stigma has been identified as a factor associated with lower exercise behavior and is commonly directed towards higher-weight individuals in exercise contexts. According to the weight-based social identity threat model, experiencing weight stigma is associated with psychological distress, and consequent decreases in motivations to engage in health behaviors where stigma is likely to occur (e.g., exercise). Despite cross-sectional support for this theory, there are no experimental studies that demonstrate if and how weight stigma impacts exercise outcomes among higher-weight individuals. This pre-registered experimental study examined the effects of a weight stigma induction on psychological stress, intentions to exercise (ITE), and exercise behaviour. Physically active higher-weight women ($N = 170$, $M\text{age} = 57.2$, $SD = 5.5$) were randomly assigned to read a fictional news article (weight-stigmatizing vs neutral condition) and completed measures of psychological stress (pre/post-induction), ITE (post-induction), and exercise behavior 7-days later (post-induction). Participants who were exposed to the stigmatizing content reported a significant increase in stress and lower ITE, compared to the control condition. There was no impact of study condition on self-reported exercise behavior at follow-up. Further, stress did not mediate the relationships between study condition and exercise outcomes, as theorized. Overall, experiencing weight stigma is psychologically stressful for higher-weight individuals and may negatively impact intentions to engage in future exercise, yet this does translate to exercise behavior. It is possible that weight stigma reduces engagement in specific types of exercise, such as public and social exercise, rather than reducing overall exercise behavior, particularly among physically active individuals.

Team Dynamics in Esports and Traditional Sport: Similarities and Differences

Charlotte Raue-Behlau, University of Muenster; Dennis Dreiskämper, University of Muenster; Bernd Strauss, University of Muenster

Traditionally, sport teams were present on the field, with key sport groups frameworks being based on that premise (e.g., Carron & Eys, 2012). In contrast esports teams may be present in different geographic locations and play virtually together against opponents (e.g., Pedraza-Ramirez et al., 2020). Tang (2018) argues the underlying team dynamics to be similar. In order to examine how team performance and effectiveness is established, Rico and colleagues (2008) propose a framework, which incorporates virtual and face-to-face settings. Based on that framework the aim of the present study is twofold. 1) Examine the relationship of team trust and collective efficacy to shared mental models (SMMs) and its effect on team performance in esports and traditional sport teams. 2) Compare traditional and esports teams empirically (Leis et al., 2021). Data were collected with online questionnaires. In total, 159 esports players (149 male; M=22.58 years old; SD=4.09; M=4.49 years of experience; SD=3.77) and 164 traditional team sport players (39 male; M=23.54 years old; SD=5.99; $M = 13.49$ years of experience; SD = 5.49) participated. The SEM model for joint data ($\chi 2(2) = 2.23$, $p > .05$; CFI = .99, RMSEA = .02, SRMR = .03) showed good fit with all predictors being significant and generally replicated the framework. Similarly, the SEM model for traditional teams ($\chi 2(2) = 2.6$, $p > .05$;CFI=.99, RMSEA=0.04,SRMR=0.04), and the SEM model for esports teams ($\chi 2(2) = 0.6$, $p > .05$; CFI=1.0, RMSEA = 0, SRMR = .03) separately showed good fit with all predictors being significant. Only the pathway trust on SMMs was significantly higher ($z = 2.08$, $p = .02$) for esports teams ($b = .42$) than for traditional teams ($b = .21$). The current study provides evidence that similar team dynamics apply in esports and traditional team sports. The high degree of virtuality seems to make team trust more important in esports teams. These results show that scientists as well as practitioners transfer knowledge from traditional sports to esports. Funding source: DFG research training group 1712-2 "trust and communication in a digitized world".

Investigating Intraindividual Variability of Psychological Needs Satisfaction and Relations With Subsequent Physical Activity

Erin Reifsteck, UNC Greensboro; Derek Hevel, UNC Greensboro; Shelby Anderson, UNC Greensboro; Amanda Rebar, Central Queensland University; Jaclyn Maher, UNC Greensboro

Self-Determination Theory (SDT) is one of the dominant theoretical frameworks used to examine motivation of physical activity (PA) engagement. Despite calls for investigating the dynamic variability of motivation, SDT-based research in the PA domain often employs cross-sectional and longitudinal approaches focused on between-person determinants. Ecological momentary assessment allows researchers to examine the within-person variability of key SDT constructs, such as needs satisfaction, in day-to-day contexts in relation to PA participation. The purpose of this study was to examine the extent to which psychological needs fulfillment in PA predicted greater subsequent PA using an approach allowing for disaggregation of within-person data from between-person data. Students ($N = 89$; $M\text{age}=22$; 52% Female; 47% White) enrolled in an undergraduate kinesiology course wore an accelerometer for 6 days and reported daily ratings of basic psychological needs. Separate multilevel models examined the extent to which reports of competence, autonomy, and relatedness for the previous day's PA predicted minutes of PA (> 2020 cpm) the following day while controlling for gender, PA habit strength (predictor of PA outside of conscious awareness), and PA on the previous day. Participants who, on average, reported greater feelings of autonomy tended to engage in more minutes of PA the following day ($b = 3.75$, $SE = 1.86$, $p = 0.04$). On days when participants reported feeling greater relatedness than what was typical for them, they tended to engage in more minutes of PA the following day ($b = 4.17$, $SE = 2.02$, $p = 0.04$). There were no significant associations with PA at the between- or within-person level for competence, at the within-

person level for autonomy, or at the between-person level for relatedness. Psychological needs appear to vary day-to-day in college students but the extent to which these predict PA depends on the specific psychological need. Future research may benefit from capturing more contextual details surrounding PA occasions (e.g., required PA courses, uniform type of PA).

Awareness of Social Presence on Virtual Fitness Platforms and Relationship With Exercise Motivation and Physical Activity Levels

Susannah L. Reiner, Rocky Mountain University of Health Professions & Tonal Strength Institute; Michelle L. D'Abundo, Seton Hall University

The health benefits of physical activity are well-known however only around 20% of the U.S. population meets the Physical Activity Guidelines for Americans. This study aimed to explore the association of awareness of social presence in a virtual fitness platform with motivation and physical activity levels (PAL). Virtual fitness users ($n = 590$, *M*age = 42±12.7 years) participated in an online study including the International Physical Activity Questionnaire and Behavioral Regulation of Exercise Questionnaire. Relative autonomy was correlated with PAL ($r = .21$, $p < .001$, 95.00% $CI = [.13, .29]$) and predicted PAL ($F(1,588) = 27.03$, $p < .001$). Awareness of social presence was significantly related to motivation ($U = 41864.5$, $z = -5.99$, $p < .001$), and predictive of relative autonomy ($F(1,588) = 27.03$, $p < .001$). The results suggest that higher relative autonomy is associated with higher PAL in virtual fitness users. Awareness of social presence on virtual platform appears to correlate to higher levels of relative autonomy, which may influence exercise adherence.

Exercise Motivation and Physical Activity Patterns in Virtual Fitness Users During the COVID-19 Pandemic

Susannah L. Reiner, Rocky Mountain University of Health Professions & Tonal Strength Institute; Michelle L. D'Abundo, Seton Hall University

It is well-known that physical activity is a lifestyle factor with long-term benefits related to morbidity and mortality. Participation in technology as means of health promotion continues to grow but there is little research on the viability of virtual fitness in relation to long-term adoption of physical activity. The COVID-19 pandemic magnified the growth of virtual fitness with stay-at-home orders were issued. The role that virtual fitness plays in an individual's exercise experience can help determine subsequent likelihood to continue exercising as a lifestyle behavior. The purpose of this study was to explore the regulation of exercise motivation and the physical activity patterns of virtual fitness platform users. Virtual fitness users ($n = 590$, M_{age}=42 ± 12.7 years) completed an online survey including the International Physical Activity Questionnaire–Short Form (IPAQ-SF) and the Behavioral Regulation of Exercise Questionnaire–3 (BREQ-3). Based on participant responses, physical activity is categorized as low (<600 MET-minutes/wk), moderate (600-3000 MET-minutes/wk), and high (≥3000 MET-minutes/wk). Mean values were calculated on the six behavioral regulation scales on the BREQ-3(amotivation, external, introjected, identified, integrated, and intrinsic). Virtual fitness users had high levels of physical activity with 360 individuals rated as "high", 214 with "moderate", and 16 with "low" physical activity levels. A series of ANOVAs showed amotivation ($F(2, 587) = 1.63$, $p = .197$) and external regulation ($F(2, 587) = 1.28$, $p = .280$) were not significantly related to activity levels. There were significant differences between activity levels in introjected regulation ($F(2, 587) = 4.10$, $p = .017$), identified regulation ($F(2, 587) = 35.55$, $p < .001$), integrated regulation ($F(2, 587) = 38.32$, $p < .001$), and intrinsic motivation ($F(2, 587) = 23.62$, $p < .001$). Virtual fitness users included in this study showed high levels of physical activity based on Physical Activity Guidelines for Americans. Higher levels of physical activity in this population appear to be associated with higher levels of exercise motivation, a predictive measure for exercise adherence.

The Benefits of Yoga Interventions for Anxiety: A Meta-Analysis

Michael Rhoads, Metropolitan State University of Denver

Anxiety is the most diagnosed psychological disorder affecting upwards of 45 million people worldwide in 2019 (Xiong et al., 2022). Yoga is an integrative or complementary approach that may enhance the efficacy of mental health interventions (Meyer et al., 2012). Multiple studies have shown how yoga can help ease the symptoms of anxiety (Chong et al., 2011). The goal of this study was to perform a meta-analysis of published studies that examined the benefits of yoga for anxiety. In addition to our hypothesis that yoga is an effective intervention for anxiety, we also anticipate that yoga is more effective compared to a control condition under the following circumstances: 1. When more strenuous forms of yoga were practiced. 2. When instructors with more expertise administered the yoga. 3. When yoga programs incorporated postures, breath work, meditation, and relaxation. 4. When yoga was practiced for longer durations. This study was completed in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The following electronic databases were used to search and download articles: Academic Search Premier, Google Scholar, PsycINFO, PubMed, and SportDiscus. The meta-analysis was computed using the "metafor" package in R (Viechtbauer, 2010). 22 articles met the inclusion criteria. The overall summary effect size, based on the fitted random effects model, was $g = 0.58$ ($SE = 0.09$), with 95% CI [0.40, 0.75]. This weighted mean difference was statistically significant ($z = 6.51$, $p < .001$). The Q test for heterogeneity indicates statistically significant variation in the observed effect sizes beyond variation due to random sampling error ($Q = 54.08$, $df = 21$, $p < .001$). Due to the statistically significant level of heterogeneity, we plan to examine subgroup and meta-regression analyses (Durlak, (2009). This study reveals that yoga is an effective integrative or complementary therapy. These findings can help to inform policy, practice, and research.

Sleep On It: The Effect of Diurnal Variation on Coach Perceptions of Talent

Alexandra H Roberts, La Trobe University; Annette Raynor, Edith Cowan University

Talent identification (TID) involves forecasting, confirming and selecting athletes based on their potential to medal at future high-level events. TID typically occurs based on a combination of objective testing (e.g., physiology), previous competition results, and the subjective "coach's eye". We have previously demonstrated a lack of agreement between coaches with intra and inter-coach variability observed in "the coach's eye" (Roberts et al., 2020). This paper investigates a potential source of this variability, namely the effect of time-of-day and level of coaching experience on coach perceptions of talent in youth judo athletes. It was hypothesized that less experienced coaches would experience greater diurnal variation, however it would not impact overall athlete ratings or rankings. Nine junior national judo coaches (5 male, M_{age} = 35.8 + 10.6yrs) with varying levels of experience (12.9+8.9yrs) evaluated 24 state-level cadet athletes (13-15yrs) at seven timepoints (morning and evening) during a four-day training camp. Each athlete's 'potential for future performance' was rated on an 11-point Likert scale from 'limited potential' to 'extremely high potential' by each coach. Data were transformed into ranking orders (1-24) based on coach ratings and placed into one of three groups, namely low (1-8), medium (9-16) and high (17-24) rankings at each timepoint. Despite no new information about athletes being provided between rating opportunities, less experienced coaches had a greater but less predictable change between the two ratings, when compared to their more experienced counterparts. This presentation will discuss the effect of experience and diurnal variation on judgements of

athlete potential and the efficacy of using a group of coaches to make selection decisions. There is a need to better understand the variability observed within and between coaches during TID and how to most effectively exploit the "coach's eye" for effective decision-making.

Virtual-Reality Training of Elite Boxers Preparing for the Tokyo 2020 Olympics During the COVID-19 Pandemic

Thomas Romeas, Université de Montréal, Institut national du sport du Québec; Basil More-Chevalier, Université de Montréal; Mathieu Charbonneau, Institut national du sport du Québec; Samir El Mais, Boxing Canada; François Bieuzen, Université Laval, Institut national du sport du Québec

The COVID-19 pandemic struck right during the Olympic preparation, leading to significant training restrictions such as the inability to have contact during training sessions for combat sports. This applied case study describes the application of a complementary virtual-reality (VR) intervention to train elite boxers preparing for Tokyo 2020 during the pandemic. It also addresses the evaluation of broader visuo-cognitive functions in elite boxers. Six boxers were allocated to two groups: one experimental group trained on a 360° virtual-reality (360VR) temporal video-occlusion program and one active control group trained on a VR game simulation (VRG), both during 11 sessions. Pre- and post-evaluations of specific decision-making performance were performed on a 360VR evaluation test. Fundamental visual and visuo-cognitive functions were assessed at baseline. On-test decision-making changes in performance (90% CI) were greater in the 360VR trained group compared to VRG, and 360VR offered self-reported satisfactory, representative, and safe individual training opportunities for the boxers. More research is warranted to explore the applications of 360VR and VR simulation for psycho-perceptual-motor skill evaluation and training. Superior visuo-cognitive performance was observed in elite boxers compared to non-athletic age-related normative samples and should also be a topic of further investigation. This study of elite athletes presents a methodological approach, its implementation, and reflections towards the applied use of VR in the sporting environment. Funding source: Own The Podium Innovations for Gold grant.

An Increase in Lower Extremity Injury as a Result of Cognitive and Psychological Deficits of Concussion

Caitlin Schult, East Carolina University; Gustavo Sandri-Heidner, East Carolina University; Nicholas Murray, East Carolina University

Sport-related concussions have shown to have effects on self-efficacy, oculomotor performance, reaction time and an increased risk of lower extremity injury (LEI). To understand the relationship between concussions and its effects on LEI it is important to understand what is going on cognitively and psychologically to detect what factors remain long-term. Current athletes ($N = 9$), who have suffered at least one concussion in the past 2 years, completed an online survey to measure self-efficacy relative to sport after being cleared to return-to-play (RTP) post-concussion. Confidence about RTP was reported in 11.9% of the athletes. The mean scores on the survey indicated there were low levels of self-efficacy when RTP. The second aim involved participants ($N = 25$), 5 of which suffered a concussion in the past 2 years, completing two surveys on their history of concussion and LEI. These participants completed a virtual GO/NO-GO task presented in a virtual reality eye tracking enabled headset to measure oculomotor performance. Reaction time during the task was measured using an EEG cap. There was no correlation between concussion and LEI and no differences in saccadic eye movement reaction time during the task. A comparison of channel spectra indicated differences ($p < .05$) in frequency bands across channels in the frontal and parietal regions of the brain and changes ($p < .05$) in ERD and ERS in frequency bands of the frontal and parietal regions between the groups. The results of this study suggest cognitive and psychological effects due to concussion could produce an increased risk for LEI in athletes. While the correlation between report of concussion and LEI was not significant, it is clear the long-term effects of concussions are causing differences in reaction time and self-efficacy. Since sports demand high levels of attention, confidence, and decision-making, concussed athletes that RTP too soon from a concussion may not have sufficient cognitive and psychological resources to operate appropriately during sport events, and thus may be at higher risk of further injury.

Potential Moderators and Mediators of Intervention Effects in a Sport-based Mental Health Program for Adolescent Men

Matthew Schweickle, University of Wollongong; Caitlin Liddelow, University of Wollongong; Scott Graupensperger, University of Washington; Jordan Sutcliffe, University of Wollongong; Christian Swann, Southern Cross University; Stewart Vella, University of Wollongong

Adolescent men are at an increased risk of developing mental illness. Problematically, young men are more likely to hold negative attitudes towards traditional approaches for addressing mental health. Identifying alternative avenues for mental health promotion and prevention in adolescent males is, therefore, of considerable importance. Research has demonstrated sports to be an engaging, and potentially effective context for mental health promotion. Ahead of the Game (AOTG) is a sport-based, psychoeducational initiative conceived and implemented to explore the viability of sports as a vehicle for mental health promotion. This study builds on a significant body of literature relating to the AOTG's development, evaluation, and implementation and answer the important questions of 'for whom' and 'through what mechanisms' does the AOTG intervention work. In addressing these questions, moderation and mediation analyses were used. A sample of 350 male sport participants, aged 12-18 years ($M = 14.53$ years, $SD = 1.19$ years), took part in the AOTG intervention. A further 466 male sport participants ($M = 14.66$ years, $SD = 1.39$) were in the control group. In both groups, various mental health related measures were taken at baseline and at approximately 8 weeks follow-up. Specifically, moderation analyses were conducted to examine age, socio-economic status, and baseline measures of mental health as potential moderators of program effects. Mediation analyses were conduced run to explore whether changes in mental health were mediated by changes in AOTG's various primary mental health related outcomes. Results indicated that there were no meaningful age nor SES-related moderation effects. A moderating effect was found for baseline psychological distress influencing changes in resilience. Mediation analyses revealed that changes in resilience mediated changes in psychological distress and wellbeing. Additionally, increases in perceived parental support mediated benefits in wellbeing. The implications and future directions, in light of these findings, are discussed. Funding source: Movember.

A Qualitative Exploration of Coaches' Perceptions of Clutch Performance in Sport

Matthew Schweickle, University of Wollongong; Jacob Hufton, University of Wollongong; Stewart Vella, University of Wollongong

The concept of clutch performance (i.e., positive performance under pressure) has gained significant research traction within the last decade. Despite this interest, there remains conceptual confusion over the conditions required for clutch performances to occur. This confusion has resulted in several, conflicting definitions of clutch performance, inhibiting progress within the field. An important, yet overlooked aspect, in considering how to define clutch performance is coaches' perspectives of what constitutes clutch performance. Such perspectives are important as previous research has suggested that athletes' often draw on their coaches'

expectations and feedback in determining if they performed well under pressure. Accordingly, this study sought to explore coaches' perceptions of what constitutes clutch performance, and when these performances may occur. Twelve coaches (M_{age} = 48 years), who coached athletes between a semi-elite and successful-elite standard, participated in career-based, semi-structured interviews (M = 48 minutes). Data were analysed using reflexive thematic analysis. Three themes were generated: (1) *the performance level required for clutch performance can vary*, suggesting that both *maintained*, and *improved*, performance may be sufficient for clutch performance, depending on the context; (2) *clutch performance may be facilitated in diverse ways*, suggesting that some athletes may be more likely to produce a clutch performance than others; and, (3) *clutch performances occur during an appraisal of increased pressure,* suggesting that clutch performances do not solely occur during 'objective' pressure situations (e.g., key moments during an event), but rather, can occur as a result of an internal appraisal of pressure (e.g., when an athlete is pushed beyond their comfort level). Overall, this study provides insights into how to define and conceptualise clutch performance, and ultimately, suggests that clutch performance may be a context-based phenomenon.

Achievement Goals and Behavioral Outcomes Among At-Risk Youth

Yanhao Shao, Texas A&M University; Jiling Liu, Texas A&M University; Ping Xiang, Texas A&M University; Han Chen, Valdosta State University

Achievement Goal Theory is an important theory to understand and explain children's cognition, affect, and behavior. Although it has been frequently used, few studies have connected the theory with objectively measured physical activity, especially among at-risk youth. The purpose of this study is to examine the relationship between achievement goals and at-risk boys' physical activity levels and other behavioral outcomes in a summer sports camp. Participants were 51 at-risk boys (M_{age} = 11.95, SD = 1.33) from underserved families. Achievement goals were assessed using a questionnaire at the beginning of the camp, Moderate-to-vigorous physical activity (MVPA) was measured using accelerometers worn on the waist during activity time, and intention for future participation (IFP) assessed using a questionnaire at the end of the camp. All questions were based on a 5-point Liker scale and the data were analyzed using SPSS, while the accelerometer data were analyzed using ActLife. Scale reliability for achievement goals and IFP was acceptable (αs = 0.60–0.93) except for performance avoidance goals (α = 0.53), hence it was excluded from further analyses. The average amount of MVPA was 29.44% (SD = 9.98) per session. Among the correlations, only performance approach goals (PAps) were significantly correlated with MVPA (r = 0.34, p < .05) and IFP (r = 0.46, p < .01). Multiple regressions showed that PAps were the sole significant predictor for MVPA (β = 0.35, p < .05) and IFP (β = 0.44, p < .01). This result might be due to coaches' emphasis on competitiveness between individuals and between groups in the sports camp. It supports the literature that PAps can lead to positive behavioral outcomes. Although the result suggests endorsement of PAps, we recommend not to overlook benefits of mastery approach goals, based on the research conducted in typical physical activity settings. For future research, we suggest examining how different settings may affect children's goal orientations and how coaches' support might influence children's participation.

An Exploratory Qualitative Study of Cognitive Impairment and Physical Activity in Young Adults After Cancer Treatment

Sitara Sharma, University of Ottawa; Jennifer Brunet, University of Ottawa

Many young adults aged 18-39 years describe struggling with cancer-related cognitive impairment (CRCI) after treatment. CRCI (e.g., memory, concentration, and learning difficulties) can cause distress, diminish quality of life (QoL), and impede young adults' participation in academic, recreational, and social experiences. Research is needed to better understand the impact of CRCI on young adults after cancer treatment, as well as the cognitive-behavioural strategies they use to self-manage CRCI. In this exploratory qualitative study, we investigated young adults' lived experiences with CRCI and their thoughts around physical activity (PA) as a self-management strategy. Sixteen young adults treated for cancer (M_{age}=30.8 ±6.0 years; 87.5% female) with clinically-meaningful CRCI (i.e., scores <54/72 on the *Functional Assessment of Cancer Therapy—Cognition* scale) were interviewed after completing an online survey and neuropsychological tests as part of a larger, mixed-methods study. Using thematic analysis, 4 main themes comprising 15 sub-themes were identified. CRCI was described as a "constant, general fog" largely attributed to cancer treatments that had multidimensional consequences on QoL. Specifically, CRCI created social (e.g., strained relations), psychological (e.g., lost self-identity), emotional (e.g., lowered self-worth), physical (e.g., thwarted ability to complete daily tasks), and professional (e.g., impaired performance) difficulties. To self-manage CRCI and reduce its consequences, 3 common strategies were cited: organization, cognitive training, and PA. Yet, participants desired and offered suggestions for increased support (e.g., informational support on CRCI, greater access to PA during treatment). Our results highlight that CRCI has negative effects on many aspects of young adults' lives and must be addressed more systematically in practice. They also shed light on the possible role of PA as a self-management strategy for CRCI, but research efforts testing the processes by which this may occur and confirming the effects of PA on CRCI are warranted. Funding source: SSHRC.

Physical Self-Evaluations and Self-Compassion in Adolescents: An Experience Sampling Study

Kelsey Sick, Western University; Jenna Gilchrist, University of Waterloo; Kristen Lucibello, University of Toronto; Eva Pila, Western University

Evaluations of the physical self are important drivers of physical activity behavior, particularly in adolescence. Examining relations between physical self-evaluations (i.e., physical self-perceptions, body-related emotions) and protective factors (i.e., self-compassion) may advance knowledge of adolescent physical self development. The aims of the present study were to examine the (i) within-person associations between self-compassion and body-related emotions (i.e., shame, embarrassment, pride), (ii) between-person associations between self-compassion, body-related emotions, and physical self-perceptions (i.e., appearance, strength), and (iii) the moderating roles of physical self-perceptions. In an experience sampling study, adolescents (N = 103; M_{age} = 16.11 ± 1.22 years) completed a baseline assessment of self-perceptions, and 5 daily reports of self-compassion and body-related emotions. Estimated from multilevel models, higher average levels of self-compassion were associated with higher frequency of endorsing body-related pride (γ_{01} = 0.68, 95% CI[0.37, 0.98]), and lower body-related shame (γ_{01} = -0.37, 95% CI[-0.56, -0.18]) and embarrassment (γ_{01} = -0.38, 95% CI[-0.59, -0.18]). More positive average levels of physical self-perceptions ($\gamma_{02strength}$ = 0.23, 95% CI[0.08, 0.44]; $\gamma_{02appearance}$ = 0.53, 95% CI[0.33, 0.73]) were associated with higher frequency of body-related pride, yet no significant interaction effects were found. Within-participants, self-compassion was not significantly associated with body-related emotions. The pattern of findings supports extant literature documenting the protective utility of self-compassion and positive self-perceptions at the between-person level. Considering the day-to-day variability in self-compassion and body-related emotions, future research is needed to explicate the nature of these associations. On average, compassionately relating to the self

and holding positive perceptions of one's physical self might be psychologically advantageous, and advance understanding on factors linked to physical activity. Funding source: Social Sciences and Humanities Research Council (SSHRC).

Can a Brief Equity, Diversity and Inclusion Module Increase Kinesiology Students' Empathetic Awareness of People Who Experience Weight or Race Biases?

Jenna Sim, University of British Columbia Okanagan; Kaela Cranston, University of British Columbia Okanagan; Mary Jung, University of British Columbia Okanagan

Many individuals with overweight and obesity or from racialized groups experience stigma and bias from healthcare practitioners. Small Steps for Big Changes (SSBC) is a diabetes prevention program designed to empower individuals at risk of type 2 diabetes to make diet and exercise changes in their lives. It is important to train SSBC coaches on equity, diversity, and inclusion (EDI) to reduce the biases they may hold towards SSBC clients. This study investigated whether a brief EDI module could increase kinesiology students' (a population representative of SSBC coaches) empathetic awareness of people who experience weight and/or race biases. Participants were recruited through online postings, classroom visits, and email lists. Participants were randomly divided into four groups: EDI-weight, non-EDI-weight, EDI-race, and non-EDI-race. The non-EDI groups were used as a manipulation check. Empathetic awareness was measured using the empathetic awareness subscale of the Scale of Ethnocultural Empathy and then adapted to fit the weight scenario. The two EDI groups completed the brief SSBC EDI module, and the non-EDI groups watched a neutral video. Empathetic awareness was measured before and after watching either the EDI module or neutral video. The EDI-weight group reported significantly higher mean empathetic awareness to overweight individuals post-module ($M = 5.64$, SD = 0.65) compared to pre ($M = 5.19$, SD = 0.76, p = 0.02). There was no difference in empathetic awareness towards racialized individuals from pre ($M = 4.91$, SD = 1.01) to post module ($M = 4.91$, SD = 0.82, p = 1.0). These results suggest that a brief EDI module can increase kinesiology students' empathetic awareness towards people who experience weight biases. Funding source: Stober Foundation; SSHRC.

Effect of University Athletes' Non-Face-to-Face Class Perception on Class Satisfaction Through Academic Self-Efficacy

Yangeun Sim, Korea National Sport University; Yanghee Kim, Korea National Sport University

This study is to investigate the class perception of the university athletes for non-face-to-face classes caused by COVID-19 and its relationship with academic self-efficacy and class satisfaction. The study targeted 251 athletes of K University in S. Korea. The online class recognition (Kim, 2021) as a research tool consists of real-time zoom lectures and video online lectures, and is a Likert 4-point scale. Academic self-efficacy (Shin, 2021) consists of factors of learning and performance self-efficacy, and is a Likert 5-point scale. Class satisfaction (Lee, 2021), which is a single factor, is a 5-point Likert scale. The collected data were analyzed through SPSS 23.0 and Hayes (2018)'s PROCESS macro (v.3.3) model 4 to verify the parallel multi-mediation effect, and the mediating effect was further verified through bootstrapping. Results show that, first, real-time zoom lectures did not significantly affect class satisfaction, but among academic self-efficacy, learning self-efficacy ($\beta = .577$, $p < .001$) and performance self-efficacy ($\beta = .436$, $p < .001$) were significantly affected. In addition, learning and performance self-efficacy as parameters ($\beta = .490$, $p < .001$, $\beta = .340$ $p < .01$, respectively) had significant effects on class satisfaction. Secondly, online video lectures had significant effects on class satisfaction ($\beta = .473$, $p < .001$), learning self-efficacy ($\beta = .960$, $p < .001$) and performance self-efficacy ($\beta = .784$, $p < .001$). In addition, learning and performance self-efficacy as parameters ($\beta = .437$, $p < .001$, $\beta = .332$ $p < .01$, respectively) had significant effects on class satisfaction. Thirdly, investigation of the multi-mediated effect on academic self-efficacy in the relation between real-time zoom lectures and class satisfaction shows that indirect effect on learning and performance self-efficacy (95% CI = .111~.480, 95% CI = .076~.319, respectively) was significant. Fourthly, similar investigation for online video lectures shows that indirect effect on learning and self-efficacy (95% CI = .158~.687, 95% CI = .059~.507, respectively) was significant.

10-Weeks of Resistance Training Intervention, Then What?

Morgan A. Smith, Auburn University; Danielle D. Wadsworth, Auburn University; Michael D. Roberts, Auburn University

Although controlled resistance training (RT) studies provide an environment to examine the effects of exercise on study outcomes, few studies have identified how training studies contribute to participation in exercise following the study. This study investigated whether participation in a 10-week RT intervention increased participation in RT at 3-months following the intervention. Sedentary women ($n = 30$, age = 21.4 ± 2.1years) completed 10 weeks of total body RT. At the conclusion of the study (PRE) and 3-months post-intervention (POST), participants completed the Exercise Experience Instrument survey evaluating the relationship between participation in an RT intervention and the potential influence on participating in RT at POST. The instrument is divided into nine questions on a Likert type scale, assessing participants' future intent, motivation, confidence, and self-reported RT participation following an exercise intervention. Changes in the response outcomes for each question were evaluated using paired samples t-test. Statistical significance was set at $p < 0.05$ a priori. At POST, women's motivation to participate in RT utilizing exercises in the training study increased significantly (PREmean = 4.133, POSTmean = 4.233, $t = -.619$, $p = .005$). There were not corresponding increases in self-reported RT (PREmean = 4.800, POSTmean = 3.833, $t = 4.455$, $p = 1.000$), nor participation in the RT exercises conducted in the study (PREmean = 1.133, POSTmean = 2.767, $t = -7.184$, $p = .977$). Participants' confidence in the ability to participate in RT (PREmean = 4.900, POSTmean = 4.433, $t = 3.458$, $p = .202$) was also nonsignificant. Although participation in a controlled RT training study increased women's motivation to be active, this did not translate into women participating in RT following the intervention. While self-reported RT and confidence in RT ability did not statistically increase, these variables were maintained. Future studies should explore ways to further facilitate prolonged participation in RT in sedentary women without accountability to the intervention.

Combating Anti-Fat Biases and Weight Stigma Among Future Kinesiology and Health-Related Majors: A Pedagogical Intervention

Daria Sosna, San Francisco State University; Megan Arauzo, San Francisco State University; Gretchen George, San Francisco State University; Nicole Bolter, San Francisco State University

Studies show that anti-fat biases are held by physical education teachers, exercise science students, and fitness professionals, and that weight stigma can negatively affect an individual's motivation to exercise and engagement in physical activity. These issues are not limited to Kinesiology majors, as anti-fat biases and weight stigma practices are prevalent among other health-related majors and professions (e.g., medicine, nutrition, counseling, nursing). This pilot study sought to explore the effectiveness of a weight stigma pedagogy intervention for students pursuing Kinesiology and other health-related majors. Three instructors

of a lower-division health and social science course were trained to implement a 3-module lecture series on weight stigma, the environmental sources of obesity, and body appreciation. Participants ($N = 81$; 48 [64.6% female; 77.1% non-white; 72.9% first year; 40.4% overweight or obese BMI range] from intervention [INT] classrooms, 33 [66.7% female; 69.8% non-white; 51.5% first year; 42.5% overweight or obese BMI range] from comparison [COM] classrooms) completed a survey at the end of the semester regarding their anti-fat biases and body appreciation. Results revealed no differences in outcomes between students in treatment vs comparison classrooms F (4, 74) = .93, $p > .05$; Wilks' Lambda = .952, partial $\eta^2 = .05$. Self-reported BMI was a significant covariate F (4, 74) = 3.76, $p = .008$; Wilks' Lambda = .831, partial $\eta^2 = .28$, specifically on Fear of Fat attitudes that capture participants' concerns about weight and the personal relevance of being or becoming fat. A significant correlation emerged between BMI and Fear of Fat for COM students ($r = .52$, $p < .01$) but not for INT students ($r = .28$, $p > .05$). Findings suggest the intervention may have impacted how students form their anti-fat biases in relation to their BMI. Future interventions should take a more immersive pedagogical approach and be implemented in a sport and exercise psychology course specifically.

Social Support Index and Sedentary Behavior Among US Adults With and Without Mobility Impairment

Jessie Stapleton, University of North Florida; M. Ryan Richardson, University of North Florida

Mobility impairment is the most prevalent physical impairment or disability in the United States. Unsurprisingly, the available evidence suggests sedentary behavior is greater among adults with mobility impairment than adults without impairment. Sedentary behavior poses tremendous health risks, and the Health Action Process Approach illustrates that resources, including social support and finances, directly influence behavior. As such, the purpose of the present study was to examine the relationship between social support index (SSI) and sedentary behavior among adults with and without mobility impairment. The sample ($n = 1822$) included U.S. adult (≥40 years of age) participants in the 2007-2008 National Health and Nutrition Examination Survey (NHANES). This cycle of NHANES was the last to record social support variables. Categories of SSI were created using low 0 to ≤3 and high >3 to ≤6. Categories of socioeconomic status (SES) were created using the ratio of family income to poverty threshold and included ≤ 1 (referent group), >1 to ≤2, >2 to ≤4, and >4. The dependent variable was sedentary time (upper quartile). Two logistic regressions were performed to predict sedentary time by demographic variables and SSI among adults with and without mobility impairment. For the primary logistic regression, the full model was significant (p<.0001), albeit age, sex, SES, nor SSI were significant predictors of sedentary time among adults with mobility impairment. For the secondary analysis, the full model was also statistically significant ($p < .0001$), and SES was the only significant predictor (OR 3.59; 95% Cl 1.80-7.15, $p < .0001$) of sedentary time among adults without mobility impairment. In adults reporting no mobility impairment, an SES >4 remained a significant predictor of increased sedentary time, independent of SSI. Additional modifiable determinants of sedentary time need to be examined among adults with and without mobility impairment to inform subsequent interventions.

Move Better to Feel Better: A Mixed-Methods Exploration of the Impact of an mHealth App on Perceptions of Functional Movement and Physical Fitness

Matthew Stork, University of British Columbia; Sara McCreary, University of British Columbia; Corliss Bean, Brock University; Mary Jung, University of British Columbia

movr is an mHealth app that has been shown to enhance functional movement and physical fitness by prescribing physical training based on personalized movement assessments. movr's app usability and impact on perceptions of physical functioning are unknown. The purpose of this study was to explore participants' receptivity to the movr app and examine how using the app impacted perceptions of functional movement and physical fitness. Forty-eight healthy adults (24 women, 24 men; M_{age}: 24 ± 5 years) were randomly assigned to 8 weeks of using the movr app ($n = 24$) or 8 weeks waitlist control ($n = 24$). A concurrent embedded mixed-methods design was used. The quantitative component consisted of self-reported measures of physical activity enjoyment (PACES) and satisfaction with physical fitness (SPF). The qualitative component consisted of one-on-one semi-structured interviews among a random subsample of 15 participants in the movr group. Measures were taken, and interviews were conducted, pre- and post-intervention. Mixed repeated-measures ANOVAs revealed no changes in PACES for either group ($ps > .05$). Only a significant main effect of time was found for SPF ($p = .02$), such that scores increased pre- to post-intervention in the movr group ($p = .01$), but not in the control group ($p = .45$). Using a codebook thematic analysis, five overarching themes were identified. Three themes were linked to app usability (perceived benefits of app use, challenges, recommendations) and two themes were linked to perceived impact on functioning (physical, psychological). The movr app was well received and positively impacted participants' perceptions of functional movement and physical fitness (e.g., flexibility, strength). Such findings showed that movr improved perceptions of physical functioning over an 8-week period and provided new insights about the usability and accessibility of the app. It appears that movr is a user-friendly tool that may be used to enhance perceptions (and measures) of functional movement and physical fitness among healthy adults. Funding source: Mitacs and Lululemon Athletica.

Motivation States to Move, Be Physically Active and Sedentary Varies Throughout the Day in a Circadian Waveform

Matthew Stults-Kolehmainen, Yale – New Haven Hospital; Cyrus Dadina, Dobbs Ferry High School (NY); Miguel Blacutt, Teachers College – Columbia University; Daniel Boullosa, Federal University of Mato Grosso do Sul; Christopher J. Budnick, Southern Connecticut State University; Garrett Ash, Veterans Affairs Connecticut Healthcare System; Adrian Haughton, Yale School of Medicine; Tao Lu, Texas Tech University

Numerous investigations have surmised that the motivation to be physically active and sedentary is transient (i.e. such as a want, desire or urge) and varies throughout the day. However, we are aware of no study that has measured daily undulations in physical activity motivation. The purpose of this study was to model how motivation varies throughout the day and if there are associations of motivation with pleasure/displeasure and arousal, across a period of 8 days. Twenty-eight adults from the U.S. were recruited from MTurk crowdsourcing (Amazon, Seattle, WA). Participants completed 6 identical surveys each day on SurveyMonkey for 8 days after waking up and every 2-3 hours thereafter until bedtime. The participants completed both Past Week (WEEK) and Right Now (NOW) versions of the CRAVE scale to measure motivation states for movement (MOVE) and sedentarism (REST). They also completed the Feeling Scale (pleasure/displeasure) and the Felt Arousal Scale. Twenty-one participants (mean age 37.7; 52.4% female) had valid data. MOVE-NOW (mean/SD) at Days 1 and 8 were 23.3 ± 12.6, 22.9±11.8; REST-NOW was 21.6 ± 14.2, 15.8±13.4; MOVE-WEEK was 30.8 ± 8.6, 28.6 ± 9.9, and REST-WEEK was 17.6 ± 13.7, 16.4 ± 12.3. Correlations from Days 1 to 8 were .62 for MOVE-WEEK and .87 for REST-WEEK. At Days 1 and 8, MOVE-NOW correlations with pleasure were low (.18, .19) and with arousal were moderate (.54, .78). REST-NOW correlations with pleasure were low (-.38, -.58); with arousal

were low (-.35, -.35). WEEK measures did not significantly change across 8 days. Visual inspection of NOW data suggests that: a) movement states varied widely across the day, b) most participants had a single wave each day. Cosinor analysis in SAS determined that the functional waveform was circadian for MOVE for 81% of participants and 62% for REST. The peak of each wave for MOVE was approximately 11 AM-4 PM. Meanwhile the peak for REST varied widely but was typically before bedtime. Motivation states to move and rest vary throughout the day and appear to have a circadian waveform. Funding source: None.

Qualitative Evidence of the Association of Psychological Stress and Mental Health Factors With Motivation States to be physically Active and Sedentary

Matthew Stults-Kolehmainen, Yale – New Haven Hospital; Todd Gilson, Northern Illinois University; Alberto Filgueiras, Rio de Janeiro State University; Christopher J. Budnick, Southern Connecticut State University; Fabio Amador Bueno, Gateway Community College; John B. Bartholomew, The University of Texas at Austin; Nicholas SantaBarbara, Merrimack College; Miguel Blacutt, Teachers College – Columbia University; Jessica Barker, Winona State University; Garrett Ash, Veterans Affairs Connecticut Healthcare System

Stress, mood, poor mental health may both impair and instigate physical activity and sedentarism, but how they influence these behaviors is poorly understood. The purpose of this study is to determine if evidence exists to link psychological stress, boredom, and mental health with motivation states (e.g., desire, urge, craving) to move and rest. Seventeen undergraduate students (mean age = 18.6, 13 women, 7 non-white) engaged in 1 of 7 focus groups where 12 structured questions were presented. Researchers used content analysis to analyze results. Psychological stress, both subjective and objective, emerged as a major theme, and participants frequently cited stress as a barrier or instigator of motivation states to move (e.g., "Stress makes me want to move.") and rest (e.g., "My desire to rest is normally about stress."). Stressful emotions (e.g., "freaking out", being overwhelmed), life stressors (e.g., transition to college, COVID, family death), demands (e.g., lots of schoolwork, heavy sport training), work/rest imbalance and hassles were all regarded as influential in either activating or inhibiting motivation and behavior. Several participants stated that they utilized exercise as a method to cope and regulate emotions. Stress also resulted in feelings of numbness or being frozen, not wanting to move or rest at all. Both good and poor mood were commonly cited as influencing desires to move, be productive and rest. Excitement and eustress typically were related to increased drive to move, but also lack of stress and understimulation – feelings of boredom and monotony. Interestingly, not being able to satisfy or consummate an urge or craving to move or rest resulted in stress, frustration, and agitation. Various mental health conditions, such as anxiety, ADHD, bipolar disorder, and body image problems were associated with episodes of being "in a rut" or hyperactive/manic. Depression and trauma were not discussed by any participant. Overall, it appears that stress interacts with motivation states in a complicated manner to influence behavior. Funding source: None.

Linking Mindfulness With Moral and Interpersonal Aspects of Sport

Cheryl Stuntz, St. Lawrence University; Justin Brackett, St. Lawrence University; Zoe Barnhart, St. Lawrence University

Mindfulness refers to open and receptive awareness and attention towards the present moment. Past research shows clear benefits of mindfulness across a broad variety of settings, including reduced stress, emotional reactivity, and negative emotions, and enhanced quality of life (see Langer & Ngnoumen, 2018). While research examining associations between mindfulness and outcomes within the sport context are much more limited, several studies have linked greater mindfulness to better athletic performance, lower injury risk, and enhanced athlete mental health (e.g., Anderson et al., 2021). Research outside the sport domain has shown that lower mindfulness is linked to increased aggression (e.g., Shorey et al., 2015), lower levels of moral reasoning (e.g., Pandey et al., 2017), and weaker social connections and satisfaction with relationships (e.g., Adair et al., 2017, McGill et al., 2016). The current study was designed to further examine relationships between mindfulness and moral and social aspects of sports. Participants ($N = 290$) completed measures of dispositional mindfulness, sportspersonship, aggression, cohesion, satisfaction with social relationships, and social loafing. In a series of hierarchical regression analyses, mindfulness was a significant predictor of five out of six moral variables, explaining an additional 5% to 22% of the variance after controlling for level of contact, age, and gender. Greater mindfulness associated with more respect for social conventions, rules, and officials; full commitment toward sport; and more positive attitudes in sport as well as lower perceived legitimacy of and intention to perform aggression. After controlling for level of contact, age, and gender, mindfulness was a significant predictor of all social variables, explaining an additional 6% to 26% of the variance. Greater mindfulness associated with more satisfaction with peer relationships, less social loafing, and more task and social cohesion. Enhancing dispositional mindfulness provides a promising avenue for enhancing moral and social outcomes in sport.

Using Open Goals in Physical Activity Programs: Reflections and Recommendations From a Feasibility Study

Christian Swann, Southern Cross University; Scott G. Goddard, Southern Cross University; Jacquelyn Dossetor, Southern Cross University; Sophia Barry, Southern Cross University; Alex Lawrence, Southern Cross University; Christopher J. Stevens, Southern Cross University

Open goals (e.g., to 'see how many steps you can reach today') are proposed to be a promising new strategy for promoting physical activity. Open goals are exploratory and non-specific, in contrast to the typical approach of setting specific goals (e.g., to reach 10,000 steps per day). Initial experiments reported that open goals can lead to at least as much physical activity as specific goals, with more positive experiences of the task (including greater enjoyment, more positive affect, and greater perceptions of performance) and higher intentions to repeat the activity. However, these initial studies used single-session designs meaning it is unclear whether it is feasible to use open goals within a longer-term physical activity program. Therefore, this study used a mixed-methods approach to examine the feasibility of using open goals within a 10 week step-count based physical activity program. Participants were 15 adults (13 female; *M*age = 42.53, range = 18-61) with low to moderate physical activity levels. All participants were provided with a pedometer, a diary, and were assigned open goals on a daily/weekly basis as well as for the program overall. Brief support sessions were also provided. Feasibility was assessed using step-counts, the Intrinsic Motivation Inventory, the Exercise Self-Efficacy Scale, the Physical Activity Enjoyment Scale, and the Exercise Adherence Rating Scale throughout the program. Semi-structured interviews were also conducted ($M = 21$ minutes). Quantitative data were analyzed using repeated-measures ANOVAs while qualitative data were analyzed using thematic analysis. Results indicated that it is feasible to use open goals in longer-term step-count based physical activity programs, as indicated by significant increases in step counts, intrinsic motivation, self-efficacy, and adherence. Participants qualitatively reported that open goals avoided negative emotions associated with failure. This presentation will summarize the benefits of open goals and will provide recommendations for using open goals in future physical activity programs.

Demographic, Medical, Motivational and Environmental Correlates of Changes in Resistance Training Among Cancer Survivors During the COVID-19 Pandemic

Allyson Tabaczynski, University of Toronto; Alyssa Neville, University of Toronto; Natalie Cuda, University of Toronto; Linda Trinh, University of Toronto

Resistance training (RT) is associated with better health outcomes for cancer survivors (e.g., fatigue, quality of life). Few cancer survivors are meeting the recommended guidelines of ≥2 sessions/week of RT, and the COVID-19 pandemic has led to further reductions in participation. The purpose of this study was to examine the demographic, medical, motivational, and environmental correlates of RT in cancer survivors during the COVID-19 pandemic. Using a cross-sectional, online survey, adult cancer survivors self-reported physical activity (PA) before and during the pandemic with the modified Godin Leisure-time Exercise Questionnaire. Motivational variables were assessed using the Multi-process Action Control Framework for reflective (i.e., instrumental and affective attitudes, perceived capability and opportunity), regulatory (e.g., planning), and reflexive (i.e., habit, identity) processes. PA environment was assessed by access to equipment, space at home or in the neighborhood, and knowledge of resources. Multinomial logistic regressions examined correlates of change in RT: abstainers (not meeting guidelines before or during; 68.5%), adopters (met during but not before; 5.2%), relapsers (met before but not during; 7.2%), maintainers (met before and during; 19.1%). Participants (N=346; M_{age}=48.3±15.5) were primarily post-treatment (80.3%), diagnosed with localized cancer (85.0%), and had a mean of 90.2±81.1 months since diagnosis. Compared to abstainers, RT adopters had significantly greater PA identity (p=.03) and RT maintainers were significantly more likely to be under/normal weight (p=.04), have greater self-regulation (p=.004), and PA identity (p=.001). Compared to adopters, RT maintainers had significantly greater PA habits (p=.049). Cancer survivors with better regulatory and reflexive processes towards PA were more likely to perform RT before and during the pandemic. RT interventions should extend beyond traditional social-cognitive approaches, and encourage processes such as habit formation that are relevant for maintenance. Funding source: University of Toronto COVID-19 Student Engagement Award.

Understanding Physical Activity of People With Poor Mental Health Using the Multi-Process Action Control framework: A Moderated Serial Mediation Model

Yiling Tang, The University of British Columbia; Madelaine Gierc, The University of British Columbia; Victoria Whiteford, The University of British Columbia; Guy Faulkner, The University of British Columbia

It is well established that individuals with poor mental health are less physically active than individuals with good mental health, in part due to symptoms like fatigue, cognitive errors, and anxiety. Little work has investigated the application of theoretical models of physical activity (PA) to individuals with mental illness despite the crucial role of theory in intervention development. The objective of this study was to test the Multi-Process Action Control (M-PAC) framework, which includes constructs for both intention formation and translation of intentions to behaviour, in understanding PA among individuals with perceived good vs. poor mental health. A cross-sectional secondary data analysis was performed on a sample of 13,881 Canadian adults (mean age = 46.7 ±10.7). Participants' self-rated mental health status was dummy coded as good (74.8%) or poor (25.2%). Reflective processes (e.g., attitudes), intention, regulatory processes, and moderate-to-vigorous physical activity (MVPA) were also self-reported. A moderated serial mediation model was performed using multigroup path analysis with AMOS. There were no differences between groups for most direct and indirect pathways. The model was partially moderated by mental health. The effects of affective attitudes on intention (B = .277, p < .001) and intention on regulation (B = .357, p < .001) were significantly stronger among those with poor mental health. The strongest indirect effect and total effect on MVPA for the poor mental health group were observed in the effect of intention on MVPA via regulation (B = .042, p<.001) and in perceived capability (B = .166, p < .001) respectively. Overall, results suggest the M-PAC framework may be suitable for informing intervention development among adults with poor perceived mental health. In particular, interventions may benefit from focusing on perceived capability, affective attitudes, and regulatory skills toward PA. Future research should experimentally examine the full M-PAC model with reflexive processes to better inform PA promotion among adults with poor mental health. Funding source: Four Year Doctoral Fellowship to Yiling Tang from the University of British Columbia, Canada.

School-Based Physical Activity in Elementary School: Does Positive Affect at Recess Play a Role?

Janelle Thalken, Oregon State University; Isabella Ozenbaugh, Oregon State University; Deanna Perez, Oregon State University; Alexandra Szarabajko, Oregon State University; Maya Trajkovski, Oregon State University; William Massey, Oregon State University

School-based recess, an environment where approximately 40% of all school-day physical activity (PA) is accrued (Erwin et al., 2012), is one of the only unstructured parts of the school day where students can engage their peers while being physically active. Recess can be a positive experience for some students, but rife with negative experiences for others (McNamara et al., 2018). Previous research has examined associations between affective states and PA among children in daily living (Dunton et al., 2014); therefore, examining these states in a recess context may provide additional understanding and promote PA among this population. The purpose of the present study was to examine the relationship between children's affect at recess and school-day PA. A total of 53 students in grades third through fifth were assessed for perceptions of acute affect at recess, as well as global perceptions of the recess environment. Acute affect was assessed via a 7-day recall that corresponded with a physical activity measurement period. The assessment of global perceptions of the recess environment included items of positive support, such as having friends and supportive adults at recess, as well as negative experience such as being ignored, excluded, and being kicked or punched. School-day physical activity behavior was measured using a hip-worn pedometer for at least three days. Moderate-to-vigorous physical activity (MVPA) was collected across all days of wear, and average MVPA time counts for each participant were calculated. Linear regression models were conducted in Mplus v8.2 to examine, a) the relationship between acute positive affect at recess and MVPA, and b) global perceptions of the recess environment and MVPA, controlling for sex and grade level. Acute positive affect at recess significantly predicted MVPA (β = .395, p = .014). No relationship was found between global perceptions of the recess environment and MVPA. Study findings suggest that positive affective experiences at recess may be valuable for student's school-day physical activity behavior. Funding source: Not applicable.

Does MVPA Buffer the Association Between Body-Related Shame and Flourishing?

Delaney E. Thibodeau, University of Toronto; Kristen M. Lucibello, University of Toronto; Catherine M. Sabiston, University of Toronto

Flourishing is an indicator of mental health, but it can be diminished with experiences of body-related shame. Identifying factors that may protect

against the negative effects of body-related shame is important for bolstering mental health, and understanding the relationships for females and males is warranted. Physical activity may be a protective lifestyle factor that can diminish the negative effects of body shame on perceptions of flourishing. The purpose of this study was to investigate moderate-to-vigorous physical activity (MVPA) as a moderator of the association between body shame and flourishing. A sample of 527 participants (80.6% White, 55.6% male, $M_{age}(SD) = 35.86$ (11.11) years) completed measures of body-related shame and flourishing, and also reported bouts of MVPA over the last 7 days. Females reported significantly ($p < .05$) higher perceptions of flourishing and higher body-related shame compared to males. Among males, the model revealed that MVPA was a significant moderator between body shame and flourishing ($F(1,288) = 5.48$, $R^2_{change} = .015$, $p<.05$) suggesting MVPA is a protective factor against the negative effects of body shame to repress perceptions of flourishing. Among females, MVPA was not a significant protective factor ($p > .05$) such that regardless of MVPA, higher self-reported shame was associated with lower flourishing ($p < .001$). The findings from this study suggest that while MVPA may serve as a buffer against the influence of body shame on one's perception of flourishing among males, it appears that MVPA does not protect against the negative effects of body shame on flourishing for females. These results highlight a need for greater understanding of the impact of MVPA for mental health among females, and a need to identify ways that self-conscious body shame can be mitigated.

Heart Rate and Respiratory Rate Correlations With Children's Affective Responses to Exercise During Physical Education

Sinika Timme, University of Potsdam; Jona Kunz, University of Potsdam; Ralf Brand, University of Potsdam

Children's affective responses to exercise during physical education (PE) can have a critical impact on children's motivation to lead physically active lifestyles, even in the long term. Dual mode theory (Ekkekakis, 2003) posits that exercise intensity plays a critical role in determining the valence of immediate core affective responses to exercise. In this study, core affective responses during physical education classes and its correlations with heart rate and respiratory rate were modeled and statistically analyzed. Repeated measures (observations) of psychological (affective responses) and physiological variables (heart rates and respiratory rates) were collected from 94 children ($M_{age} = 13.25$, $SD_{age} = 0.75$, 48% female) during 12 PE sessions in six German schools. Affective valence was measured with the Feeling Scale (scale range -5 to 5) every 10 minutes. Heart rate and respiratory rate were continuously recorded with wearable sensor technology at a sampling frequency of 60 Hz.Mixed model analysis revealed an overall average affective response of 2.15 (95% CI [1.46, 2.84]) with high intra- ($\sigma^2_{\boxtimes} = 1.96$) and inter-individual ($\sigma^2_{ID.date} = 2.81$) variability. Respiratory rate (but not heart rate) correlated negatively with affect ($b_{RR} = -0.02$, 95% CI [-0.04, -0.01]) at the intra-individual level. At the inter-individual level, both mean respiratory rate and mean heart rate correlated positively with mean affect for each individual within sessions ($b_{RR} = 0.13$, 95% CI [0.06, 0.20]; $b_{HR} = 0.03$, 95% CI [0.02, 0.05]). Disentangling different sources of variability revealed different correlations depending on the level of analysis (e.g., intra- vs inter-individual). The role of heavy breathing in generating core affective feelings during PE classes should be further analyzed in experimentally controlled research designs with level-specific variables.

Neuropathic Pain Experiences Among Paralympic Versus Recreational Athletes With Spinal Cord Injury

Kendra Todd, University of British Columbia; Kenedy Olsen, University of British Columbia; Gail Hamamoto, British Columbia Wheelchair Sports Association; Trevor Hirschfield, Wheelchair Rugby Canada; John Kramer, University of British Columbia; Kathleen Martin Ginis, University of British Columbia

Individuals with spinal cord injury (SCI) report high levels of neuropathic pain. Physical activity (PA) may reduce neuropathic pain among persons with SCI; however, it is not yet known whether the volume of PA is related to athletes' neuropathic pain experiences. The purpose of this study was to compare neuropathic pain intensity, pain catastrophizing, use of pain coping strategies and positive affect and well-being among two groups that differ in their weekly PA frequency and intensity: Paralympic versus recreational athletes with SCI. Forty-seven athletes with SCI (25 Paralympic, 27 recreational, M_{age}= 38±11.8 years) completed the International SCI Pain Basic Data Set, Douleur Neuropathique-4, coping strategies questionnaire, pain catastrophizing scale, SCI-quality of life assessment and a structured interview. Paralympic athletes reported significantly greater neuropathic pain ($p = .015$) than recreational athletes, but also significantly greater positive affect and well-being ($p = .049$). No other comparisons were significant ($ps > .09$). Significant, positive correlations were observed between neuropathic pain and total minutes of moderate-intensity PA ($r = 0.335$, $p = .023$) and average duration of moderate-intensity PA bouts ($r = .375$, $p = .010$) over the past week, regardless of athletic status. The results suggest that Paralympic-level athletes experience greater positive affect and well-being than recreational athletes, which may explain why they can continue participating in high-intensity sport, despite experiencing greater neuropathic pain. Future research should investigate additional psychosocial moderators and mediators of the relationship between PA intensity and neuropathic pain to develop analgesic PA prescriptions which better support Paralympic level athletes with SCI and neuropathic pain. Funding source: Social Sciences and Humanities Research Council; WorkSafeBC; Killam Trusts.

Awareness of the 24-Hour Movement Guidelines for Adults Over Time Among Adults Living in Canada

Jennifer R. Tomasone, Queen's University; Olivia Varkul, Queen's University; Kaitlyn D. Kauffeldt, Queen's University; Tala Chulak-Bozzer, ParticipACTION; Melissa C. Brouwers, University of Ottawa; Mary Duggan, Canadian Society for Exercise Physiology; Stephanie M. Flood, Queen's University; Rebecca Jones, ParticipACTION; Kirstin N. Lane, University of Victoria; Amy E. Latimer-Cheung, Queen's University; Guy Faulkner, University of British Columbia

Awareness of movement behaviour guidelines is an essential antecedent to behaviour change in common social marketing models. Unfortunately, only 13% of adults living in Canada were aware of national physical activity (PA) guidelines five years following their release. Replacing these guidelines, the Canadian 24-Hour Movement Guidelines for Adults 18-64 Years and Adults 65+ Years (24HMGs) were released on October 15, 2020 by the Canadian Society for Exercise Physiology, the recognized authority in exercise science and prescription in Canada. Several dissemination strategies were employed at the time of launch to increase adults' awareness of the 24HMG (e.g., release of a Communications Toolkit with promotional materials, a communications campaign, live and recorded educational workshops). The present study assessed adults' awareness of the 24HMG before, after and 6 months following their launch. In partnership with ParticipACTION, a Canadian non-profit organization promoting healthy movement behaviours, online surveys were distributed to independent, geographically representative samples of adults at three timepoints: pre-launch (early October 2020; $n = 1509$), two weeks post-launch (early November 2020; $n = 1462$), and six months post-launch (March 2021; $n = 2010$). Participants were asked to rate their level of familiarity with the 24HMG on a 4-point scale (*1 = very familiar, 4 = not at all familiar*). Awareness was analyzed using frequency counts, and differences in awareness across timepoints were analyzed using chi-square tests. Results suggest significant increases in 24HMG awareness over time

($X^2(2) = 44.908$, $p < 0.001$); participants' awareness significantly increased between pre- (21.6%) and post-launch (31.9%; X^2 (1) = 40.0, $p < 0.001$), and was maintained 6 months later (29.7%; X^2 (1) = 1.6, $p = 0.20$). Strategies used to disseminate the 24HMG enhanced their awareness among adults living in Canada. However, sustaining dissemination efforts over time are required to further increase population-level awareness. Funding: Public Health Agency of Canada. Funding source: Public Health Agency of Canada.

Physical Activity and Mental Health Among Canadian Post-Secondary Working Students

Daniel Trafford, McMaster University; Steven R. Bray, McMaster University; Matthew Kwan, Brock University

Estimates indicate more than half of Canadian post-secondary students work while completing their education. Further evidence shows post-secondary students who work outside of school report lower levels of mental health (MH) compared to those who do not work. Increased physical activity (PA) has shown beneficial effects on post-secondary students' MH and, thus, may be particularly beneficial for working students. In this study, we investigated the effect of working status on the relationship between PA and MH among post-secondary students. It was hypothesized that work status would be associated with lower PA; however, given the positive effects of PA on MH, it was expected that working students who were more physically active would report better MH than working students who were less active. Data was drawn from Cycle 2 of the Canadian Campus Wellbeing Survey (CCWS) and included 33,279 ($M = 21.0$ years ± 2.89; 67.8% female) full-time students from 50 Canadian postsecondary institutions. The CCWS includes items on work status, and measures of moderate-to-vigorous PA (MVPA; International Physical Activity Questionnaire), and MH (Warwick-Edinburgh Mental Wellbeing Scale). Multiple linear regression analyses were conducted to examine work status (working/non-working) and PA (i.e., meeting or not meeting PA recommendations of >150 minutes of MVPA) as predictors of MH. Contrary to expectations, results showed working students were significantly more likely to be physically active ($p < .001$, OR = 1.23) and report greater MH scores ($p < .001$) than non-working students. A significant work status X MVPA interaction ($p = .01$) indicated that working students that were sufficiently active had significantly higher MH compared to working students who were not sufficiently active ($p < .001$) and non-working students regardless of activity status ($ps < .005$). Results suggest that working students might manage their time better and, therefore, are more capable of greater PA engagement, and may perceive work to be more fulfilling or provide additional purpose in their lives.

"And I Still Remember It to this Day:" A Qualitative Exploration of Retrospective Memories of School-Based Recess

Maya Trajkovski, Oregon State University; Deanna Perez, Oregon State University; Janelle K. Thalken, Oregon State University; Isabella Ozenbaugh, Oregon State University; Alexandra Szarabajko, Oregon State University; William V. Massey, Oregon State University

Previous research has shown the most common memory of physical education (PE) was embarrassment, and that childhood memories of PE relate to physical activity (PA) attitude, intention, and sedentary behavior in adulthood (Ladwig et al., 2018). Recess memories may have a similar effect on adult attitudes towards PA, given that recess is a physically active part of the school day, yet is more autonomous and less supervised than PE. Recent literature has supported this, as Massey and colleagues (2021) reported memories of recess enjoyment were associated with PA enjoyment in adulthood, whereas negative recess memories were associated with social isolation. In an effort to better understand recess memories, and how they may be related to adult behaviors, the purpose of this study was to examine qualitative descriptions of adults' best and worst recess memories. As part of a larger project, 515 participants between the ages of 19 and 79 ($M = 45.56$; $SD = 15.62$) were surveyed. Participants were asked to recall their best and worst recess memories and the grades in which those memories occurred. Participants identified as predominantly female (50.8%), White (71.8%), and college educated (47.1%). Data analysis was conducted within Atlas.ti and independently analyzed via an inductive content analysis by three research team members. Results showed that the most common negative memories included injuries, conflict, bullying, and exclusion. The largest proportion of negative memories were reported in 5th grade. The most common positive memories included were playing sport and non-sport specific physically active games, connecting with others, and performing well. The largest proportion of positive memories were reported evenly between 3rd – 5th grade. Participants were more likely to recall a "best" memory ($n = 500$) than a "worst" memory (n = 460). This study adds to a growing line of research documenting the importance of recess as a developmentally impactful environment with implications for physical and emotional health.

Haptic and Motor Functions Differ Between Musicians and Non-Musicians

Hung Tsai-Chun, National Tsing Hua University; Tseng Yu-Ting, National Tsing Hua University

Musicians have been found to show increased fine motor skills through extensive piano practice. Numerous studies have reported that proprioception is increased in musicians who regularly play musical instruments. However, little is known about haptic function, the combination of proprioception and touch perception, is improved in musicians. The purpose of this study was to systematically investigate haptic function and how it is linked to different domains of motor skills in musicians. Twenty-two musicians (age 21.91±3.05 years) and 22 controls without previous experience of music (age 21.77±3.09 years) participated. All participants performed two haptic tasks: 1) a haptic detection task and 2) a haptic discrimination task. The haptic block system consists of 18 plastic blocks with different curvatures on the top of block surfaces. During the detection task, participants touched a single haptic block with their dominant index fingers and were asked to judge whether the block was curved or not. In contrast, during the haptic discrimination task, participants explored two haptic blocks and identified which of the two blocks was more curved. The haptic sensitivity (measured by haptic detection thresholds) and haptic acuity (measured by discrimination thresholds) were obtained to measure haptic function. Bruininks-Oseretsky Test of Motor Proficiency, Second Edition, Long Form (BOT-2-LF) was used to assess different domains of motor functions. The independent *t*-test revealed that the musician group demonstrated a higher haptic haptic sensitivity (decreased haptic detection thresholds) when compared to their controls ($p = 0.049$). However, haptic acuity was not significantly different between the two groups ($p = 0.108$). The Pearson product-moment correlation coefficient showed that the haptic detection thresholds significantly correlated with manual coordination measured by BOT-2-LF ($r = -0.582$, $p < .01$). This study documented that musicians have higher haptic sensitivity, which is linked to their greater manual coordination.

The Interaction of Positive and Negative Body Image Predicting Psychological Outcomes

Sarah Ullrich-French, Washington State University; Anne Cox, Washington State University

Historically, body image research has focused on negative experiences such as guilt and shame about one's body. However, body image is a

complex and multi-dimensional construct that can be positive, negative or both. The absence of negative body image does not necessarily represent the presence of positive body image. A recent proliferation of research on positive body image demonstrates positive relationships with psychological well-being, physical activity, self-care, intuitive eating among other positive outcomes (see Tylka, 2018). Positive and negative body image can co-occur as distinct constructs, but how combinations of positive and negative body image operate together is understudied. This study tested the interaction of positive (i.e., body appreciation) and negative body image (body guilt and body shame) predicting depression, anxiety, and stress. Participants ($N = 465$) completed a survey assessing study constructs. Hierarchical regression was used to predict each outcome with positive and negative body image variables entered in step one, followed by the two-way interactions in step two. No interactions predicting stress or anxiety yielded significant increase in explained variance. The prediction of depression resulted in significant increased explained variance ($p < .01$) with the interaction of appreciation x shame ($b = -.15$, $p<.01$). Simple slopes analyses revealed a significant positive slope of shame predicting depression with lower body appreciation ($b = .26$, $p < .01$) but a non-significant slope for higher appreciation ($b = .04$, $p = .46$). Similar results emerged with the appreciation x guilt interaction ($b = -.11$, $p<.02$). Simple slopes analysis revealed a positive slope of guilt predicting depression with lower appreciation ($b = .18$, $p < .01$) and a non-significant slope with higher appreciation ($b = .01$, $p = .84$). These results show a small buffering effect of body appreciation in attenuating the relationship between negative body image indicators of guilt and shame and depression. Further research is needed to unpack the nuances of different combinations of body image.

Exploring Self-Objectification and Mindfulness in Online Yoga and Resistance Training Classes

Amy Valdez, California State University Fullerton; Kathleen S. Wilson, California State University Fullerton; David Chen, California State University Fullerton; Daniela A. Rubin, California State University Fullerton

When individuals internalize that their body is evaluated based on attractiveness, feelings of body shame and body surveillance (self-objectification) emerge as well as decreased mindfulness. Participation in physical activity is related to a positive body image; however, this may vary depending on the type of activity. Participation in yoga has been related to lower levels of self-objectification and increased mindfulness. However, few studies have compared different types of physical activity. The purpose of this study was to compare changes of mindfulness and self-objectification in college students enrolled in yoga versus resistance training (RT) classes. It was hypothesized that self-objectification would decrease, and mindfulness would increase in students enrolled in yoga versus those enrolled in RT. Students ($M_{age} = 22.3$ years, SD=3.8; 60% female; 47.4% Hispanic) who took online basic hatha yoga ($N = 17$) and RT (N=35) classes for credit during Spring 2021 participated in this study by completing online surveys at Week 9 and Week 16. The surveys included the State Mindfulness Scale for Physical Activity and the body surveillance and body shame subscales from the Objectified Body Consciousness Scale. Two MANOVAs compared changes over time in mindfulness and self-objectification between the two types of classes. For mindfulness, there was a significant class effect ($p = .004$) with students in yoga reporting higher levels of mindfulness of the mind than those in the RT class. For self-objectification, there was a significant increase in both body surveillance ($p = .014$) and body shame ($p=.044$) over time. The class by time interaction was not significant for mindfulness ($p = .885$) nor self-objectification ($p = .328$). These results support the potential influence of yoga on experiences of mindfulness. With the unexpected increase in self-objectification in students in both classes, future research could explore factors in physical activity college classes that may reduce self-objectification.

Moving in the Presence of Others: A Systematic Review and Meta-Analysis on Social Facilitation

Edda van Meurs, University of Münster; Jona Greve, University of Münster; Bernd Strauss, University of Münster

The classic definition of social facilitation describes the "increase in response merely from the sight or sound of others making the same movement" (Allport, 1924, p. 262). Performance in cognitive or motor tasks was facilitated, inhibited or not affected, argued to be a function of task complexity (Zajonc, 1965). In his narrative review on motor tasks, Strauss (2002) found the presence of others to positively affect condition-based tasks (general drive hypothesis, Zajonc, 1965), and to negatively affect coordination-based tasks due to higher cognitive demands (overload hypothesis, Manstead & Semin, 1980). In a systematic review and meta-analysis, we tested this hypothesis including experimental research over 100 years.Through forward searches of Scopus, PsycINFO, Web of Science and Academic Search Premier, and backward searches of several reviews (Bond & Titus, 1983; Landers & McCullagh, 1976; Strauss, 2002; Oviatt & Iso-Ahola, 2008), we searched for studies that (a) compared a measure of motor performance in the presence of or coaction with others and alone, (b) were published in a scientific journal, (c) analyzed original empirical data, (d) investigated human subjects, and (e) provided sufficient information for effect sizes. Competition and archival studies were excluded.For the systematic review, we found $N = 72$ (1924-2019) articles (5,419 participants). Condition-based tasks appear to be facilitated, while coordination/accuracy-based tasks performed under time- and precision-pressure show inconsistent results. The meta-analysis ($N = 28$ effects) found a medium non-significant effect, $g = 0.24$, 95% CI [-0.01; 0.50], $p = .061$ with high heterogeneity. The moderator analysis generally aligned with the systematic review: condition-based tasks are facilitated ($g = 0.68$, $SE = 0.21$), while the effect sizes for tasks with coordination demands are smaller and show more variability. Finally, we support the drive- and overload hypothesis and draw conclusions for the state of the theory and experimental limitations specific to social-facilitation research on motor tasks.

The Effects of a Single Bout of Aerobic Exercise on Cognition: The Moderating Role of Aging

Jarod C. Vance, University of North Carolina Greensboro; Jennifer L. Etnier, University of North Carolina Greensboro

There is a continuum of cognitive aging progressing from normal age-related cognitive decline through mild cognitive impairment to more severe forms of clinical impairment. With the growth of the older adult population, developing low-cost interventions to minimize cognitive decline is critical. Previous research has shown that both acute and chronic exercise are positively related to cognitive functioning. However, most of these studies have focused on young adults, with few studies examining older adults. Therefore, the purpose of this study was to compare cognitive functioning changes in response to a single bout of aerobic exercise in young and older adults. Regularly active (≥90 mins/week) cognitively normal young ($n = 15$, $M = 23.67$ yrs) and older adults ($n = 8$, $M = 66.43$ yrs) were recruited. A within-subjects design was used with the order of conditions randomized and counter-balanced. The Rey auditory verbal learning test (RAVLT) was performed on a no-exercise day (control) and following 20 min of moderate-to-vigorous intensity aerobic exercise.

Memory outcomes from the RAVLT included: short-term memory (STM, Trial 1); learning (Trials 1-5); delayed recall (Trial 7); and 20-min recall (Trial 8). Mixed ANOVAs assessed differences in memory by condition (exercise vs. control) and age group (young vs. older). There were significant differences between conditions for STM, learning, delayed recall, and 20-min recall, Fs = 4.56 - 45.85, ps < .05. For all outcomes, the exercise condition resulted in significantly more words recalled than the control condition. Although the condition X age group interactions were not significant, the study is underpowered (.111 – .251) and effect sizes suggest that benefits may be greater for the older adults ($\eta^2_{partial}$: .500 vs. 300). This study provides an important extension to the literature by showing both young and older adults benefit cognitively from a single bout of moderate intensity exercise. These results could indicate that even later in life, behavioral interventions could mitigate the rate of cognitive decline. Funding source: NASPSPA Graduate Student Research Grant.

Validation of the Body Appearance and Function Embarrassment Scales in Adults

Madison F. Vani, University of Toronto; Kristen M. Lucibello, University of Toronto; Catherine M. Sabiston, University of Toronto

Body-related embarrassment is a negative self-conscious emotion that can be experienced in physical activity contexts where there are ample opportunities for social evaluation. However, embarrassment contextualized to the body's appearance and function has received minimal empirical attention despite its association with physical activity avoidance. Advancements to our understanding of body-related embarrassment is limited by the lack of appropriate measures. To address this gap, we constructed measures and tested the items for reliability and validity evidence. The purpose of this study was to validate the newly developed Body Appearance and Function Embarrassment Scales. Adults (N = 532; Mage = 28.01, SD = 5.90; 67% women) completed the scales, and additional validated self-report measures of other body-related self-conscious emotions, social physique anxiety, global embarrassment, affect, self-esteem, physical self-concept, body and functionality appreciation, body surveillance, self-consciousness, depressive symptoms, and physical activity. Confirmatory factor analyses assessed the factor structure of the appearance and fitness items separately, and Bivariate correlations and Steiger's Z transformations assessed convergent and discriminant validity. The analyses revealed a one-factor solution for each subscale that explained 79% and 82% of the variance among appearance and fitness items, respectively. All factor loadings were appropriate (appearance = .83-.91; fitness = .87-.93) with low standard errors. The appearance and function items demonstrated internal consistency coefficients of ω = .91 and ω = .93, respectively. Convergent and discriminant validity was evidenced by significant associations with adaptive constructs (e.g., body appreciation), maladaptive constructs (e.g., body surveillance), other body-related self-conscious emotions, and physical activity in the expected directions. Use of these scales will help to increase the understanding of how affective body image influences physical activity engagement and experiences. Funding source: NASPSPA Graduate Student Research Grant.

What Contributes to Developing Attraction or Antipathy to Exercise During Adulthood? Exploring Need Satisfaction and Thwarting During Childhood

Spyridoula Vazou, Iowa State University; Jace Leininger, Iowa State University; Panteleimon Ekkekakis, Iowa State University

Background. According to research on Self-Determination Theory, both the satisfaction and thwarting of the needs for autonomy, competence, and relatedness may influence engagement and participation in sports. Further, based on the Affective-Reflective Theory of physical inactivity and exercise, affective exercise experiences over the life course may uniquely contribute to physical activity (PA) behavior. However, it is unknown whether need satisfaction and need thwarting during youth PA participation may shape affective exercise experiences (e.g., attraction or antipathy towards exercise) during adulthood. Using a retrospective survey, we examined whether memories of need satisfaction and need thwarting during youth PA and sport relate to present-day reports of affective exercise experiences during adulthood. Methods. An online questionnaire was completed by 1739 adults (1093 women, M_{age} = 27.15 ±12.65 years). Participants completed the Basic Psychological Needs in Exercise Scale (BPNES; Vlachopoulos & Michailidou, 2006), the Psychological Need Thwarting Scale (PNTS; Bartholomew et al., 2011), and the Sports Climate Questionnaire (SCQ; Deci & Ryan, 2007) regarding their memories from youth PA participation, and the Affective Exercise Experiences (AFFEXX; Ekkekakis et al., 2021) questionnaire. Results. Hierarchical multiple regression showed that satisfaction of the need for autonomy and competence were the strongest predictors of antecedent cognitive appraisals, core affective experiences, and overall attraction to exercise, whereas thwarting of the need for relatedness was the only predictor of most AFFEXX factors. Conclusions. Results demonstrated the role of perceived need satisfaction and need thwarting in predicting reports of affective exercise experiences during adulthood.

Cross-Training the Brain: How Simultaneous Exercise and Cognitive Training Improve Memory Across the Lifespan

Emma Waddington, McMaster University; Jennifer J. Heisz, McMaster University

Age-related atrophy is prominent in the hippocampus — a brain region that subserves memory processing. Although prior research demonstrates the added benefit of combining physical exercise and cognitive training to improve memory across the lifespan, most interventions have used two separate activities rather than a single activity that integrates the two. The sport of orienteering seamlessly combines running with spatial navigation, and therefore serves as a naturalistic form of multimodal training where physical and cognitive processes are trained simultaneously. The present observational study assessed whether engagement in the sport of orienteering was associated with spatial and episodic memory. One-hundred and fifty-eight people (age $M(SD)$ = 48 ± 20 years, range = 18-86 years), including 44 physically active controls with no orienteering experience and 114 orienteers with intermediate to elite level skills, completed the Survey of Autobiographical Memory to obtain separate measures of spatial and episodic memory. Spearman's rank correlations assessed whether orienteering experience and physical activity level were associated with these two memory domains. The results revealed an interesting dissociation. On one hand, more orienteering experience was associated with better spatial memory ($r2$ = 0.50, p < .001) and this was true regardless of one's physical activity level. On the other hand, more physical activity was associated with better episodic memory ($r2$ = 0.17, p = .03) but this association was dependent on orienteering experience. Taken together, the results highlight the importance of simultaneously combining physical and cognitive training to augment brain function, and suggest that incorporating the sport of orienteering into an active lifestyle may help improve memory in both spatial and episodic domains. Funding: NSERC. Funding source: NSERC.

Effects of Social Identity on Flourishing and Program Adherence Among Older Adults Involved in Virtual Exercise Programs During the COVID-19 Pandemic

Katrina J. Waldhauser, University of British Columbia; Benjamin A. Hives, University of British Columbia; Yan Liu, Carleton University;

Ryan M. Hulteen, Louisiana State University; Geralyn R. Ruissen, University of British Columbia; Colin M. Wierts, University of British Columbia; Ryan E. Rhodes, University of Victoria; Eli Puterman, University of British Columbia; Mark R. Beauchamp, University of British Columbia

The Seniors COVID-19 Pandemic and Exercise trial was created in response to the anticipated vulnerability of older adults for risk of severe illness and mortality, as well as social isolation and depleted mental health during the early stages of the COVID-19 global pandemic. Low active older adults (≥ 65 years) were randomized to receive one of two 12-week virtual exercise programs (via group-based or individual programs) or a waitlist control condition. This secondary analysis examined the potential moderation effects of participants' social identification with their respective programs on participants psychological flourishing and program adherence trajectories over the 12-week programs. Participants who took part in the group-based and individual programs ($N = 162$, $M_{age} = 73.52$ years, $SD = 5.61$) were offered virtual exercise classes and completed online measures every two weeks for the duration of the 12-week trial. Multilevel modeling revealed that social identity had a significant main effect on participants' perceptions of psychological flourishing (*Marginal* $R^2 = 0.019$, B = 0.65, SE = 0.14, 95%CI = [0.38, 0.92], p < .001), and to a greater extent, program adherence (*Marginal* $R^2 = 0.164$, B = 0.44, SE = 0.09, 95%CI = [0.26, 0.61], $p < .001$). These findings indicate that greater social identification among others within virtually-delivered exercise programs, at least in the context of the COVID-19 pandemic, may contribute to supporting their psychological well-being, and to a larger extent, program adherence. As such, targeting the development of older adults' social identities (in relation to other program members, whether delivered to a group or individually) may be one way of cultivating continued program participation in future studies. Funding source: Social Sciences and Humanities Research Council Canada Graduate Scholarship – Doctoral; Canadian Institutes of Health Research Operating Grant.

Narcissistic Personality in Competitive Ballroom Dancers

Xiao Wang, Beijing Sport University; Hongtao Ma, Beijing Sport University; meiqi zhang, Springfield College

Background: Narcissism refers to a state of mind that is highly focused on the self and believes that one is better than others. Clinically, narcissism is considered a psychiatric disorder when it reaches an extreme degree of pathology. However, when narcissism is at a low level, it is considered a universal personality trait, often manifesting as an excessive preoccupation and obsession with oneself, one's imagination, and one's image in the eyes of others. This study aims to reveal the narcissistic personality traits of competitive ballroom dancers.Methods: A total of 41 competitive ballroom dancers (Male = 21, Female = 20, $M_{age} = 21.76 \pm 2.2$ years, Educ = 15.15 ± 2.0 years) and 40 demographic-matched college students (Male = 20, Female = 20, $M_{age} = 20.95 \pm 2.1$ years, Educ = 14.64 ± 1.6 years) who had no dance training experience were recruited for the study. The Narcissistic Personality Inventory (Chinese version) by Zheng Yong & Huang Li was used for evaluating the narcissistic personality of the subjects. The scale consists of overt narcissism and covert narcissism subscales. The independent sample t-tests were applied to analyze the collected data.Results: There were significant differences between the dancers ($M = 82.05$, $SD = 12.50$) and control group ($M = 74.28$, $SD = 11.48$) in total scores, $t(79) = 2.91$, $p = .005$. Within the dancers, compared to the female dancers ($M = 77.45$, $SD = 10.40$), male dancers ($M = 86.43$, $SD = 12.99$) demonstrated significantly higher total scores, $t(39) = 2.44$, $p = .020$. There were also significant differences between male dancers ($M = 20.09$, $SD = 4.94$) and female dancers ($M = 16.75$, $SD = 3.52$) in power from overt narcissism subscale, $t(39) = 2.49$, $p = .017$.Conclusions: Ballroom dancers tended to have more narcissistic traits than their non-dancer peers. Also, male dancers were more narcissistic than female dancers, which may relate to the dominant role in the coupling dance.

Exploring the Existence of Relative Age Effects Among Canadian Sport Officials

Nick Wattie, Ontario Tech University; Jason Mergler, University of Manitoba; Ian Cunningham, Edinburgh Napier University

Previous research suggests that relatively younger members of youth sport age groups (i.e., born in the last six months of their age cohort) were over-represented at certain levels of soccer refereeing in France (i.e., an inverse relative age effect). This finding may reflect a 'strategic adaptation' that results from sub-optimal experiences of relatively younger athletes, and their subsequent attempt to find forms of sport participation where they are less disadvantaged. The purpose of this study was to explore whether inverse-relative age effects exist among Canadian sport officials. A demographic and macro participation history questionnaire was used to analyze the relative age distributions of a sample of Canadian basketball and soccer referees ($n = 494$; $M_{age} = 45.9 \pm 15.3$ years). Based on previous research we hypothesized that there would be over-representations of relatively younger sport officials, particularly at lower levels of expertise. However, no asymmetries in relative age distributions were observed among basketball ($\chi^2 = 2.19$, $df = 3$, $p = .54$) and soccer ($\chi^2 = 0.89$, $df = 3$, $p = .83$). Comparisons based on referees' expertise level (novice, intermediate, expert) also did not reveal any relative age effects (χ^2 range 0.44 to 2.92, $p > .05$). These results suggest that officiating is not a disproportionate strategic adaptation for relatively younger compared to relatively older participants. Furthermore, relative age does not appear to constrain expertise development among sport officials. More research, with larger samples, is needed to control for cohort effects and establish the generalizability of these findings. Additionally, research should compare the relative age distribution of referees to relative age distributions of the athlete population from which they emerge. Uniform relative age distributions among officials may still reflect an increased likelihood of transitioning to officiating for relatively younger officials if they are under-represented among athlete samples in their sport. Funding: SSHRC. Funding source: SSHRC.

Preliminary Outcomes of a Virtual, School-Based Yoga Program on Preschoolers' Sleep Habits and Physical Activity

Carissa Wengrovius, University of Michigan; Megan M. Ziembowicz, University of Michigan; Dale A. Ulrich, University of Michigan; Leah E. Robinson, University of Michigan

Children today are experiencing immense stress and may lack coping mechanisms for their health and wellbeing. Virtual delivery has yet to be explored in school-based yoga research and has the potential for greater reach in the community. The purpose of this study was to assess the preliminary effects of a virtual, school-based yoga program on sleep habits and physical activity in children. Ten classrooms across six school-based centers participated in a cluster-randomized controlled study. The five preschool classrooms (54% female, M_{age}=4.7 years) were evaluated for this present study. Classrooms were randomized into two groups: Yoga (3 classrooms, n=36) and Control (2 classrooms, n=34). The yoga program was eight weeks (3, 30-minute lessons per week) and was synchronously delivered using classroom projectors. Parents/guardians and teachers completed a questionnaire at baseline, 4 weeks, 8 weeks, and 12 weeks that included the Modified Burdette Proxy Report (MB-PA), which measures daily PA duration. Parent questionnaires also included the PROMIS Parent-Report Short Forms for Sleep Problems (PROMIS-SP)

and Physical Activity (PROMIS-PA). A repeated-measures ANOVA determined that PROMIS-SP scores did not significantly change over time for either group. However, scores differed significantly across time for PROMIS-PA ($F(3,78)=16.60$, $p<.001$, $\eta_p^2=0.39$) and teacher-report MB-PA ($F(3,90)=5.07$, $p=.003$, $\eta_p^2=0.15$) for the Yoga Group, but not for the Control Group. Post hoc tests using the Bonferroni correction revealed PROMIS-PA increased 11.8% between baseline and 8 weeks ($p=.002$) and increased another 4.3% a month after the program ($p>.05$). Teacher-report MB-PA increased by 8.6% between baseline and 8 weeks ($p=.003$) but dropped by 4.6% at the 12-week follow-up ($p>.05$). The results indicate a virtual, school-based yoga program can increase PA in preschool-aged children in school and home environments. Future research should consider using objective measures of PA and increasing dosage for greater impact on children's healthy lifestyle behaviors. Funding source: US Department of Education Office of Special Education Programs Project RPT: H325D160032; University of Michigan Rackham Graduate Student Research Grant.

"Get Off My Wave!" – Social Identity and Its Impact on (River) Surfers' Interactions With Each Other

V. Vanessa Wergin, University of Queensland/Technical University of Munich; Benedikt Perl, Technical University of Munich; Svenja A. Wolf, Florida State University

Ocean surfing is often accompanied by a strong sense of localism in surfers and negative behavior towards newcomers (e.g., Olive 2019; Olivier, 2010; Towner & Lemarié, 2020), potentially due to limited access to waves and overcrowding. River surfing seems to foster similar and partly even more extreme behaviors. This begs the question, why and how surfers develop these behaviors, in which ways they may be functional, and how they distinguish between in- and out-group members. This study applied Social Identity Theory (Tajfel, 1978; Tajfel & Turner, 1979) to investigate the identity of two distinct groups of river surfers in Munich, Germany, including group access, group prototype, and impact on surfers' emotions, cognitions, and behaviors towards each other. We conducted semi-structured qualitative interviews with $N = 10$ (5 male, 5 female, $M_{age} = 24.0 \pm 7.9$ years) river surfers of both social groups. Following pragmatism as a research paradigm, thematic analysis (Braun & Clarke, 2006) was applied, showing that social identities of the two groups varied extremely. While the more advanced group of surfers perceived themselves as having superior rights due to their skills, the less advanced group did not differentiate between skill levels and perceived themselves as an inclusive unit. Threats and bullying behaviors towards newcomers were only reported in the advanced surfer group. It appeared that due to the inaccessibility of the advanced group and their anti-social, localism-related behaviors, the less advanced group had formed as a counterweight. Both groups seemed to counterbalance each other in their emotions (e.g., aggression vs. joy), cognitions (e.g., perceptions of more vs. fewer rights), and behaviors towards each other (e.g., hostile vs. welcoming). Our results offer first insights into social identity dynamics in river surfing and provide initial explanations for the limited access to surfing communities and the development of localism attitudes in the surf sport. The findings may be used to increase awareness and prevent anti-social behaviors in surfing.

Youth's Time Spent in Sports From Before and After the COVID-19 Pandemic: The Role of Siblings

Shawn Whiteman, Utah State University; Aryn Dotterer, Utah State University; Sahitya Maiya, Utah State University; Travis Dorsch, Utah State University

In the early months of the COVID-19 pandemic, youth sport participation decreased noticeably (Dorsch et al., 2021; Edwards et al., 2021). As restrictions eased in the U.S. throughout the second half of 2020, youth began to reengage with various athletic activities; though, participation remained lower than previous years (Sports & Fitness Industry Association, 2021). Using longitudinal data collected from before and during the COVID-19 pandemic, the present study investigated the degree to which youth's time spent in sport changed over time and the sibling factors associated with their involvement. Participants were two siblings (older siblings, 51% girls; M_{age}= 15.67; younger siblings, 48% girls; M_{age}= 13.14) and one parent (85% mothers; M_{age}= 45.15) from 682 families from five states in the U.S. Midwest. Data were collected via annual surveys and four weekend diaries in which youth reported on their activities. From the diary data, we derived the proportion of weekend time youth spent in sport activities across one month. Time 1 data were collected in Fall 2019 and Time 2 data were collected in Fall 2020. Paired *t*-tests revealed that both older ($t = 2.72$, $p < .01$, $d = .12$) and younger siblings' ($t = 2.82$, $p < .01$, $d = .13$) proportion of time spent in sports decreased from before to after the onset of the COVID-19 pandemic. Results from an actor-partner independence model (APIM) revealed that older siblings' time in sports before the pandemic positively predicted ($\beta = .18$, $p<.001$) younger siblings' involvement during the pandemic (accounting for younger siblings earlier participation, $\beta = .28$, $p < .001$), but not vice versa ($\beta = .04$, *ns*). Inconsistent with modeling hypotheses, the lagged associations between siblings' time spent in sports were not moderated by either the age-spacing or gender composition of the sibling dyad. Overall, the results highlight that despite declines in youth's participation in sports from before to during the COVID-19 pandemic, older siblings' involvement in sports was an important predictor of younger siblings' continued participation. Funding source: National Institutes of Health.

Becoming a 'Runner': Examining Predictors of Change in Running Identity Among Run to Quit Members

Colin M. Wierts, University of British Columbia; Mark R. Beauchamp, University of British Columbia; Ryan E. Rhodes, University of Victoria; Bruno D. Zumbo, University of British Columbia; Carly S. Priebe, University of British Columbia; Guy Faulkner, University of British Columbia

Given previous work pointing to exercise identity as a robust predictor of exercise behavior, it is important to understand how personally identifying with exercise-related identities (e.g., a 'runner') develops across time in low-active individuals starting an exercise intervention. The study involved participants enrolled in 'Run to Quit,' a 10-week group-based program designed to help individuals quit cigarette smoking and increase exercise by learning to run. The purpose of the study was to examine key predictors of change in running identity (i.e., identifying as a 'runner') across the Run to Quit program. Participants ($N = 323$; 68.4% female; 51.8% between 40 and 54 years of age) completed baseline, mid-program (week 3), and end of program (week 10) self-report measures. Relevant predictors of change in running identity included changes in smoking identity, running frequency, self-efficacy to complete a continuous five-kilometer run at program end, and measures of cohesion via individuals' attraction to the program's task (ATG-T) and social (ATG-S) activities. Residualized change scores were created by regressing week 10 assessments on their respective baseline assessments (running identity, smoking identity, running self-efficacy, running behavior) or week 3 assessment (cohesion) and saving the unstandardized residuals. In the multiple-regression model, changes in running frequency ($b = .189$, $p < .01$), running self-efficacy ($b = .169$, $p < .001$), and ATG-T ($b = .205$, $p < .05$) were significant predictors of change in running identity. Changes in smoking identity ($b = -.230$, $p = .061$) and ATG-S ($b = .117$, $p = .068$) were not significantly related to changes in running identity. The findings highlight the role of increases in exercise behavior (i.e., running frequency), efficacy

beliefs, and attraction to exercise program activities as potentially contributing to exercise-related identity (i.e., running identity) formation among initially low-active individuals participating in group exercise. Funding source: SSHRC Joseph-Armand Bombardier Canada Graduate Scholarship.

Sociocultural Factors and Sensorimotor Control: A Scoping Review Protocol

Katherine Wilford, University of St. Augustine for Health Sciences; Texas Tech University Health Sciences Center; Maria Jesus Mena-Iturriaga, Universidad del Desarrollo; Texas Tech University Health Sciences Center; Gesine H. Seeber, University of Oldenburg; University of Groningen; Texas Tech University Health Sciences Center; Macarena Wainer, Universidad del Desarrollo; Margaret Vugrin, Texas Tech University Health Sciences Center; Shinye Kim, Texas Tech University; Toby Brooks, Texas Tech University Health Sciences Center; C. Roger James, Texas Tech University Health Sciences Center; Troy L. Hooper, Texas Tech University Health Sciences Center; Phil S. Sizer Jr., Texas Tech University Health Sciences Center

Female athletes injure their anterior cruciate ligaments more often than males. Many neuromuscular and biological differences have been identified as contributing factors to injury risk. However, these differences do not explain gender-specific sensorimotor control (SMC) observed in daily tasks or across the lifespan. There is a need to explore other important factors that may have a more subtle influence on, or relationship with, SMC. Due to well-established gender-related differences in SMC, a close examination into key sociocultural factors is warranted. To fully explore the breadth of literature, investigate methodology of previous research, and identify gaps in knowledge, a scoping review is justified. The purpose of this scoping review is to examine the correspondence between sociocultural factors and SMC. This scoping review will be conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). The following databases will be searched: Pubmed® (National Library of Medicine), Embase® (Elsevier), Scopus® (Elsevier), CINAHL Complete® (Ovid), Academic Search Complete™ (Ebscohost), Pre-Prints Database® (National Library of Medicine), and Rehabilitation Reference Center from inception to October 2020. Additionally, relevant grey literature will be identified. Screening, study selection, and data extraction will be done by two blinded reviewers. Data will be extracted from bibliometric and sociocultural variable families. Results will be descriptively mapped and the frequency of concepts, population, characteristics, and other details will be narratively reported. By understanding the correspondence between sociocultural factors and SMC, it may be possible to change movement characteristics that contribute to injury and identify individuals at risk of injury. This study will contribute to the multifaceted issues surrounding injury risk and help decrease injury incidence in young women. This project will be registered in Open Science Framework prior to data extraction. Funding source: N/A.

Self-Regulating Recovery: Identifying Perceptual-Cognitive Skills of Recovery From Hard Training Among Elite Athletes

Stuart G. Wilson, University of Ottawa; Bradley W. Young, University of Ottawa

Training for high-performance sport takes recovery, a multi-dimensional process of restoring performance between sessions (Kellmann et al., 2018). Unlike training, recovery has not been examined in a cognitive expertise paradigm (e.g., Ericsson & Smith, 1991), due to absent conceptualization of recovery as a perceptual-cognitive skill. Wilson and Young (2021) described elite athletes' recovery as a broad range of potential approaches and suggested recovery skill may involve learning to self-regulate one's approach in various contexts. This study aimed to explore how elite athletes regulate their recovery and describe potential recovery-related perceptual-cognitive self-regulatory skills. Twelve elite endurance athletes (ages 25-31; 6 men, 6 women; 8 sports; multiple recent World Championships/Olympics), completed two semi-structured interviews, separated by seven days of journaling on recovery actions. Interviews addressed their views on meanings, modes, and management of recovery; this presentation covers responses related to the latter. We used an abductive reflexive thematic analysis (Braun & Clarke, 2019) to describe athletes' self-regulation of recovery, explicitly working from a social-cognitive perspective of self-regulated learning (e.g., Zimmerman, 2006), but inductively creating themes from the data. Athletes located recovery as their responsibility and described its self-regulation through cyclical and interdependent themes of: (1) 'know your body', including knowing your tendencies, needs, and plans for recovery; (2) 'listen to your body', involving the awareness and interpretation of your sensations of recovery/stress; and (3) 'respect your body', involving adjusting and/or adhering to recovery based on what you 'know' and 'hear'. A fourth theme of 'learn your body', described how the former themes develop over time. Models of self-regulated learning were effective for guiding description of recovery regulation, and the identified perceptual-cognitive skills present a potential path forward for expertise-related research on athlete-centered recovery. Funding source: Social Sciences and Humanities Research Council of Canada.

Ski For the Team But Shoot for the Moon? Social Indispensability Effects on Effort- vs. Skill-Based Performance in Biathlon Relay vs. Individual Races

Svenja A. Wolf, Florida State University; Hannah Pauly, University of Münster; Christopher R. Hill, California State University, San Bernardino; Elke Reisch, University of Amsterdam; Carly J. Block, Florida State University

Social motivation research documents reliably that athletes perform better within relays as compared to individual races (Schleu et al., 2019; Osborn et al., 2012). In line with Karau and Williams' (1993) collective effort model, this is due to an increased sense of social indispensability, that is, athletes' perceptions that their performance is instrumental for team success (Wittchen et al., 2007). The behaviors that have been investigated, however, are (primarily) effort-based or conditioning tasks (i.e., swimming, running), in which greater effort enhances performance (Strauss, 2002). In line with Beilock and Carr's (2001) explicit monitoring hypothesis and Master's (1992) conscious processing hypothesis, we doubt that social indispensability would be equally beneficial on skill-based or coordination tasks (e.g., shooting, putting), in which greater effort can reduce performance due to athletes actively monitoring or trying to control their movements and hence disrupting movement automaticity (Strauss, 2002). To test these assumptions, we employed a quasi-experimental within-subjects design in which we compared skiing (i.e., effort-based) and shooting (i.e., skill-based) performance across individual and relay races (i.e., low vs. high indispensability) in biathlon. Currently, we are in the process of obtaining and analyzing archival biathlon data from all Olympic, World Championship, and World Cup events between 2002 and 2019. A pilot random coefficient regression analysis of one event (i.e., 276 races nested with 92 athletes, 51% men) however confirmed that biathletes skied faster (b_{1j} = 7.80, 95% CI [6.49, 9.12]) but shot less accurately (b_{1j} = 7.69, 95% CI [4.21, 11.16]) and slower (b_{1j} = -1.29, 95% CI [-1.67, -0.90]) in relay as compared to individual races (controlling for race length). Awaiting replication in the full data set, these preliminary results question an unequivocal emphasis of social indispensability on interdependent tasks and call for a greater distinction in line with task demands.

Effects of Fit-Normative and Weight-Inclusive Instagram Images on Women's Exercise Motivations

Madeline Wood, University of Toronto; Eva Pila, Western University

"Fitspiration" images on Instagram promote exercise for maladaptive weight and appearance-related reasons in young women. Fitness content depicting higher-weight bodies could promote adaptive, non-appearance exercise motives. Body compassion might protect against the negative effects of "fitspiration" exposure. Two pre-registered experiments examined (i) the effects of exposure to weight-inclusive vs. fit-normative Instagram images on young women's exercise intentions and motivations, and (ii) tested trait body compassion as a moderator of the relationships between image exposure and exercise outcomes. Using an online experimental paradigm, women aged 18-30 years old were randomized to view fit-normative, weight-inclusive, or control condition Instagram images and completed measures of state exercise intention and motivation. Study 1 ($n = 228$) employed a post-test design and found no significant effects of condition on exercise outcomes, nor significant interactions with body compassion. Study 2 ($n = 797$) used a pre-/post-test design and found that participants in the weight-inclusive condition demonstrated significantly greater increases in exercise intention (estimate = 0.51, $SE = 0.14$, $p = .002$) and fitness/health motivation (estimate = 0.20, $SE = 0.06$, $p = .01$) than controls. Moreover, the weight-inclusive condition exhibited significantly greater decreases in weight/appearance motivation relative to both the fit-normative (estimate = -0.29, $SE = .06$, $p = <.0001$) and control conditions (estimate = -0.29, $SE = .06$, $p = <.0001$). Body compassion was not a significant moderator of the associations between exposure to weight-inclusive vs. fit-normative images and exercise outcomes. Exposure to fit-normative Instagram content may encourage dysfunctional exercise motives in young women. Weight-inclusive imagery may more effectively inspire adaptive exercise intentions and motivations, and future research should investigate how it may be leveraged to improve psychosocial exercise outcomes.

Walk or Run to Quit: A Five-Year Evaluation of a Physical Activity-Based Smoking Cessation Intervention

Kelly Wunderlich, University of British Columbia; Hannah Martin, University of British Columbia; Carly Priebe, University of British Columbia; Guy Faulkner, University of British Columbia

Walk or Run to Quit (WRTQ) was a national program targeting smoking cessation through group-based running clinics. Increasing physical activity may facilitate smoking cessation as well as lead to additional health benefits beyond cessation. WRTQ was delivered in person for 3 years and then virtually for 2 years due to the COVID-19 pandemic. The aim was to evaluate the impact of Walk or Run to Quit over 5 years on smoking cessation and physical activity outcomes. Adult participants ($N = 857$) looking to quit smoking took part in 176 running-based cessation clinics in 92 locations across Canada. Using a pre-post design, participants completed questionnaires assessing physical activity, running frequency and smoking at the beginning and end of the 10-week program and at 6-month follow-up. Carbon monoxide (CO) testing pre- and post- provided an objective indicator of smoking status for the first 3 years.Overall, 51.3% of program completers achieved 7-day point prevalence [PPA; intent-to-treat (ITT) = 20.7%] and CO significantly decreased from weeks 1 to 10 ($p < .01$) for the first 3 years. There was an increase in physical activity and running from baseline to end-of-program ($ps<.01$). At 6-month follow-up, 28.0% (11.1% ITT) of participants contacted self-reported prolonged 6-month abstinence and 32.6% (13.0% ITT) were still running regularly. However, results for the community online program were less promising than the pre-pandemic in-person outcomes. Changes in running frequency per week from week 1 (0.33) to week 10 (1.2) were not statistically significant ($p = .07$) nor maintained (6-month = 0.31). Fewer community online participants reported 7-day PPA (40.9%; 16.2% ITT) compared to the first three years (52.8%; 21.3% ITT), but there were self-reported decreases in smoking (88.9%; 36.0% ITT). Although attrition was a concern, WRTQ demonstrated potential as a scalable behaviour change intervention that targets both cessation and physical activity. The program was less effective after transitioning to virtual delivery. Funding source: Public Health Agency of Canada.

Breathing Techniques and Their Effects on Physical Sport Performance: A Systematic Review and Meta-Analysis

Nina Zammit, German Sport University; Maša Iskra, German Sport University; Sylvain Laborde, German Sport University

Although the act of breathing usually occurs automatically and to a certain degree unconsciously, certain parameters, such as breathing frequency (number of cycles per minute, cpm) can be voluntarily controlled, and used purposefully to achieve beneficial physiological and psychological states. These techniques include slow-paced breathing (SPB), fast-paced breathing, voluntary hyperventilation, breath-holding, and alternate-nostril breathing. Due to the proposed benefits of these techniques and their low-cost, these may be applicable to improve physical sport performance. A systematic review was performed to investigate the effects of these breathing techniques on physical sport performance while quantitatively summarizing results through a series of meta-analyses for each breathing technique, distinguishing between acute and chronic effects. Physical sport performance outcomes were grouped into time, speed, strength, and sport specific measures. The database search was performed in July 2020 in PubMed, Web of Science, ProQuest, PsycINFO, Scopus, and SPORTDiscus. The Risk of Bias 2 framework and guidelines were used for the risk of bias assessment. A total of 28 studies were reviewed in the systematic review. Only SPB was found to positively influence physical sport performance, considering its chronic effects (medium effect). No effect was found for breath-holding (acute and chronic) and hyperventilation (acute). Due to a lack of studies, no other meta-analyses were run. Further research is required to investigate potential moderators and to develop standardized interventions with these breathing techniques. Funding source: German Sport University – HIFF L-11-10011-237-052000.

The Effect of Physical Activity on Quality of Life, Balance, and Cognition in Adults With Parkinson's Disease

Alexandra L. Ziepke, Louisiana Tech University; Andrew C. Parks, Louisiana Tech University

Parkinson's disease (PD) is the 2nd most common neurodegenerative disorder in the U.S. effecting 1-2 people per 1000 (Dashtipour et al., 2015; Tysnes & Storstein, 2017). Characterized by motor and non-motor symptoms, PD research has commonly focused on motor-based impairments seeking to gain insight into ways to counteract the degenerative progress of the disease. Non-motor symptoms, such as cognitive decline or decrease affect, have been sparingly explored within the research – especially alongside physical activity (PA). Therefore, the purpose of this investigation is to examine the influence of daily physical activity levels on balance, cognitive performance, and quality of life in adults with PD relative to healthy older adults. In this study, participants (10% female) engaged in two sessions occurring 14-days apart. In session one, participants completed a health-history demographic, PAR-Q, an IQ assessment, and were provided directions for wearing an accelerometer and completing an activity log for 14-days. During the second session, participants completed a timed up and go, quality of life inventory, Eriksen Flanker task, and a 1-back working memory assessment. Results suggest that beyond a medical diagnosis for PD, our groups did not significantly differ on any descriptive variables ($ps \geq .22$). Physical activity findings indicate no direct influence of

PA level on balance or reported quality of life in either group, however moderate-to-vigorous activity levels appear to be associated with greater cognitive outcomes in those with Parkinson's disease, but not in the age- and sex-matched health older adults. These findings suggest that engaging in daily physical activity may aid in maintenance of cognitive function in those with Parkinson's disease. Furthermore, this maintenance effect may aid in combating the neurodegenerative decline associated with the disease, suggesting that engaging in daily PA may provide a complementary tool for researchers and medical professionals to use when assisting individuals diagnosed with PD.