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2013	Richard Schmidt
2012	Richard Magill
2011	Michael Wade
2009	Beverly Ulrich
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2007	Albert Carron
2005	George Stelmach
2004	Waneen Spirduso
	Ronald Marteniuk
2003	Jerry Thomas
2002	Karl Newell
1999	J.A. Scott Kelso
1998	Glyn Roberts
1995	Daniel Landers
1992	Richard Schmidt
1989	Jack Adams
1981	Franklin Henry
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2012	Quincy Almeida
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2011	Amy Latimer
2010	Tim Welsh
2009	David Vaillancourt
2008	Sian Beilock
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2006	Paul Estabrooks
2005	Heather Hausenblas
2004	Viktor Jirsa
2003	A. Mark Williams
2001	Kathleen Martin
1998	Kerry Courneya
1997	Richard Carson
1996	Richard Van Emmerik
	Daniel Weeks
1995	Jody Jensen
1993	Stephan Swinnen
1992	Beverly Ulrich
1991	Edward McAuley
1987	Peter Hancock
1986	Les Carlton
1985	Deborah Feltz

Human Kinetics Lecture

Neural and physiological substrates mediating motor skill learning and consolidation

Julien Doyon, University of Montreal

For more than 20 years, research in my laboratory has focused on investigating the behavioral, neuronal and neurophysiological determinants of motor skill learning and consolidation. During this presentation, I will first review some of our work focusing on motor sequence learning (MSL), which refers to the process by which movement elements come to be performed effortlessly as a unitary sequence through multiple sessions of practice. I will summarize the results of studies, which demonstrate that interactions between the cortico-striatal and cortico-cerebellar systems, as well as the spinal cord, are critical for establishing the motor routines used to acquire new sequence of movements. I will then briefly discuss our studies, which show that the consolidation of such a memory trace depends upon greater functional integration of the cortico-striatal system and N-REM sleep spindle activity measured during the night following the initial training session.

Keynote Speakers

Keynote Speaker: Motor Learning and Control

Neural basis of bimanual coordination: Brain structure, function and connectivity in relation to motor behavior

Stephan Swinnen, KU Leuven

Even though bimanual coordination skills are prominent in daily life, movement neuroscience has invested relatively little effort in studying the principles underlying bimanual as compared to unimanual movement control. Nevertheless, bimanual movement is a very useful vehicle to better understand motor control under normal and pathological conditions. I will start with a brief history of the study of bimanual movement. Then, I will elaborate on brain activations associated with bimanual coordination patterns of different complexity to reveal the typical brain network associated with production of such movements in young and older participants. I will then address the role of brain structure (grey and white matter) in bimanual movement control and attempt to demonstrate how alterations in brain structure as a result of brain insults and aging are associated with changes in bimanual performance. More specifically, the relations between microstructural organization of interhemispheric (callosal) interactions and bimanual performance and learning will be discussed during normal and pathological conditions. Finally, I will focus on bimanual neural networks and report about functional brain connectivity under task-related and resting-state conditions. Using more specific noninvasive dual-site Transcranial Magnetic Stimulation (TMS) approaches, I will elaborate on functional connectivity mediated by interhemispheric interactions between motor cortex (M1), dorsal premotor cortex (PMd) and dorsolateral prefrontal cortex (DLPFC) during planning of bimanual movements with different degrees of complexity. I will provide evidence

that the left PMd shows inter-hand task-allocation specific modulations in its interaction with the contralateral M1 whereas bilateral DLPFC entertains a less specific facilitatory interaction with the contralateral M1s during preparation of bimanual actions. I will conclude with a model of bimanual movement that may serve to inspire future research on bimanual movement control.

Keynote Speaker: Motor Development

Motor coordination and child health: Understanding the connections

John Cairney, McMaster University, Canada

Previous research has demonstrated relationships among motor coordination, physical health, cognitive development and social-emotional outcomes in children and youth. In the field of developmental neuro-pediatrics and rehabilitation, children with motor coordination problems and/or delay frequently show deficits in functioning across a broad spectrum of domains, suggesting motor coordination may indeed be a fundamental factor shaping overall health and well-being. At the same time, theoretical models for understanding the pathways connecting motor ability to health-related outcomes have not kept pace with the breadth of research exploring these associations. In this lecture, I discuss recent attempts to model possible mediating and/or moderating factors connecting motor coordination to health and developmental outcomes. In particular, I focus on the *environmental stress hypothesis* as a guiding or sensitizing framework for understanding the pathways connecting poor motor coordination to emotional and behavioural problems in children, both exploring its potential and critiquing its limitations. Following this, I will discuss practice and intervention implications in relation to motor coordination and health in children and youth. Using the concept of physical literacy, I will specifically argue for the importance of positioning motor skill development as a core target for public health prevention programs in the early years. In doing so, I present a case for universally targeted motor skill programs for all children.

Keynote Speaker: Sport and Exercise Psychology

A recipe for success? The role of autonomy and interpersonal support in the pursuit of personal goals

Richard Koestner, McGill University

The talk will explore factors that promote our capacity to successfully attain our personal goals. After outlining common goal setting errors, I will describe recent research that shows people can successfully reach their personal goals if they consider why they pursue them, how they will implement them, and who will support them. The critical role of autonomy (versus control) in how we select, pursue, and disengage from goals will be highlighted. The talk is designed to provide practical information for use in your professional and personal lives. I will outline two paradoxes about personal goals. First, although personal goals are self-initiated, they often are not self-endorsed. That is, rather than setting goals that are based in one's guiding interests and values (i.e., autonomous goals), many goals are set because of external or internal pressures (i.e., controlled goals). There is now compelling evidence that autonomous goals are associated with greater goal progress because they result in reduced goal conflict, enhanced readiness, and better use of implementation plans. The second paradox is that the successful pursuit of personal goals requires interpersonal supports. We never pursue our goals alone. My research distinguishes autonomous goal support, which focuses on a relaxed, empathic response, and directive support which involves the provision of positive guidance. Across several studies, autonomy support, but not directive support, has been consistently associated with greater goal progress and improved well-being outcomes.

Senior Lecturers

Motor Learning and Control

(Action)Observations on motor learning and skilled performance

Nicola Hodges, University of British Columbia

Over the past 20 years I have been studying processes of motor learning, with a particular emphasis on action observation and what and how people learn from watching others. Combined with this interest in motor learning and practice behaviours I have had a parallel interest in processes that define experts in motor skills, especially sports. The expertise paradigm has been a useful method to both help understand how actions are performed from a general theoretical perspective, as well as to illuminate as to variables which can perhaps be trained to aid in motor skill acquisition. I have been particularly interested in testing the involvement of the motor system in action observation in general, as well as for observational learning, when action experiences have yet to be acquired and in predicting action outcomes from watching others. In this short talk, I hope to give a little insight into my motor behaviour background and talk about 3 recent methods, students and I have used to study action-observation processes; this includes; 1) the use of startle methodology, where we have studied whether observed responses of simple actions can be "kicked-out" unintentionally, 2) the visuo-motor adaptation paradigm, where we have been studying what is acquired from watching others in the absence of experience, and 3) learning and expertise methods; including temporal occlusion and secondary tasks, to probe action prediction processes following motor and visual training experiences. I hope to raise some questions and give some suggestions about how observation might best aid training of perceptual-motor skills.

Sport and Exercise Psychology

The Köhler Effect: From jocks to smocks to exergames

Deborah Feltz, Michigan State University

Motivation is a key issue in physical activity, training, and performance for exercisers, athletes, and even astronauts. While variability in motivation is popularly attributed to intrapersonal differences, a long history of group dynamics research shows that motivation is largely a product of interpersonal processes that are dependent upon the task and task structure. Understanding these processes has important implications for coaching and training practices, as well as for public health (e.g., group-based exercise). One group dynamics principle, the Köhler motivation gain effect, has been shown to positively influence motivation within sports teams and exercise programs. The Köhler effect indicates that inferior group members demonstrate motivation gains within a group task when participating with moderately more capable partners. This presentation traces the origins of the Köhler effect with male rowers back in the 1920s to more recent laboratory research to determine the theoretical mechanisms underlying the effect, and most recently to research aimed at investigating its utility to boost motivation through exergames and for intense exercise for astronauts. I will describe research evidence from sport teams and exergame groups that illustrates the Köhler effect and how different task structures and partner characteristics (including software-generated partners) within groups can influence motivation.

Supported by National Institutes of Health, Grant # 5R21HL111916-02 and NASA/National Space Biomedical Research Institute, Grant # MA03401

Motor Development

Autonomy-supportive climates: Motivating children to move and learn

Mary Rudisill, Auburn University

Many researchers have suggested that learners can achieve significant benefits from participating in autonomy supportive (rather than controlling) educational environments. To best understand the nature of autonomy-supportive climates, one should take heed of both achievement goal and self-determination theories. Central to both of these is the notion that a focus on individual progress and learning rather than group comparisons and accomplishments facilitates intrinsic motivation involvement. In essence, both theories "advocate the use of feedback and procedures that facilitate a fuller, more task involved engagement with achievement related endeavors' in order to foster intrinsic motivation. In addition the two theories use the concept of "climates" to explain how people perceive the environmental structure, including autonomy support, of a particular setting. Within the specific field of physical education, providing students with opportunities to become self-directed leads to *higher levels of skill attainment* (Hastie, Rudisill, Boyd, K., & Irwin, 2015); Hastie, Rudisill, & Boyd, 2016; Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill 2004a,b) *physical activity* (Parish & Rudisill, 2013; Parish & Treasure, 2003, 2007; Wadsworth, Robinson, & Rudisill, 2013; Wadsworth, Rudisill, Hastie, Boyd, Hernandez, & Irwin, 2015), *adaptive cognitive responses* (Wadsworth, Rudisill, Hastie, Boyd, & Rodriguez-Hernandez, 2014), *as well as increased perceptions of ability and effort* (Valentini & Rudisill, 2004a,b). Researchers from Auburn University have investigated the benefits of autonomy supportive climates in motivating children to learn to move and engage in physical activity. This lecture will review the past three decades of research related to this topic and the advancements we have made in implementing autonomy supportive climates in physical education. Learning to move is a top priority during the childhood years. Ensuring that children learn to move is critically important and has implications for health and development over the lifespan.

Early Career Distinguished Scholar Lectures

The motor competence path to health behaviors and outcomes

Lisa Barnett, Deakin University, Australia

Dr. Barnett is honored to receive the 2016 Early Career Distinguished Scholar Award for NASPSPA. She will present her career path from generalist health promotion to her focus today on children's motor competence within a public health framework. Globally, many children do not meet physical activity guidelines, are not cardiovascularly fit and are overweight or obese. Early intervention to change a child's negative developmental trajectory is crucial. Her studies have encompassed the pre-school to upper high school years and demonstrate the importance of children's motor competence to current and future health. Her research foci include: 1. Prevalence of adequate motor competence, 2. Correlates of motor competence, 3. Motor competence interventions and maintenance of effects, and 4. Health benefits of actual/perceived motor competence. These investigations have led to a growing interest in the measurement of actual/perceived motor competence. Through this presentation, Dr. Barnett will acknowledge the research mentors that have inspired her journey, the turning points that have helped shaped her career, and the lessons she has learned to date.

The NASPSPA Outstanding Student Paper Award Recipients

Motor Control and Learning

Choosing a coordination (bimanual or unimanual) strategy

Chaoyi Wang, Charles H. Shea, Texas A&M University

Two tasks (A, B) were designed which required participants to sequentially move through four target positions in a Lissajous display. Task A was designed so that the participant could complete the task using either unimanual or bimanual control strategies. Task B was designed so that participants could complete the task using relatively simple or more complex bimanual control strategies. Although the bimanual coordination literature suggests that participants tend to choose more stable coordination patterns over less stable patterns (Haken, Kelso, & Bunz, 1985; Schöner, Haken, & Kelso, 1986; Schöner & Kelso, 1988, Fontaine et al., 1997; Zanone & Kelso, 1992), there is little literature which tests a performer's preference when facing a choice of control strategies. The purpose of this study was to determine which control strategy the participant will choose to complete the two tasks and determine the degree to which the size of the targets influences the control strategy chosen. Both tasks required participants to move a cursor in a Lissajous display sequentially through four targets as fast and accurately as possible. The amplitude (A) between two adjacent targets and the target size (W) resulted in an Index of Difficulty (ID) of 2 and 4 (ID=log2 (2A/W), Fitts, 1954) for each task. For both tasks, participants (N=8) practiced 15 trials (30s per trial) for each ID and then a test trial was administered. The results for both Task A and B indicated that the ID2 condition resulted in a circular path while ID4 condition resulted in straight-line paths on the Lissajous plot. This suggests that at the low ID condition participants produced a continuous 90 degree bimanual coordination pattern. At the high ID condition, the participants consistently chose to switch between more stable unimanual left and right movements in Task

A and to perform a discrete 90 degree bimanual coordination pattern in Task B. In addition, both limbs' movements were more harmonic in the low ID condition than the high ID condition.

Motor Development

Does self-enhancement in motor skill competence and health-related fitness promote physical activity?

Till Utesch, Dennis Dreiskämper, Katharina Geukes, University of Münster; Roland Naul, Willibald Gebhardt Institute Essen

Introduction. A large body of research examines the relationship between perceived and actual motor competence (MC) and health-related fitness (HRF) as important factors for promoting physical activity (PA) and subsequently improving health (cf., Stodden et al., 2008). The overestimation of actual MC and HRF is labelled self-enhancement and it is unclear how it affects PA. This study investigates these self-enhancement-effects of perceived and actual MC as well as of perceived and actual HRF on PA. The effects of cross-sectional and longitudinal models are compared. Methods. A total number of 1699 students (age: M = 9.5, SD = .72) participated in both the 3rd and 4th grade. MC (7 items) and HRF (4 items) were measured product-oriented. Perceived motor competence was assessed via the physical self-concept (PSC; 5 dimensions) and PA via a composite index (11 items). A Response Surface Analysis, which accounts for level as well as for discrepancy, was conducted for each MC and HRF item and its corresponding PSC dimension as predictors. Results. Overall, differences between the cross-sectional and longitudinal models were identified. In the cross-sectional models, only the perceived MC showed a main effect on PA (.14 < beta < .23). In the longitudinal models, a main effect was found for the actual MC (.11 < beta < .17). No interaction effects and no self-enhancement effects were found, neither cross-sectionally (06. < LOC < .1; 02. < LOIC < .09), nor longitudinally (.059 < LOC < .92; -.05 < LOIC < .06). Conclusion. Cross-sectionally, self-concepts are positively associated with PA, whereas, longitudinally, actual MC and HRF levels promote PA, irrespective of the self-concept. Neither overestimating nor underestimating one’s own competencies substantially affect future PA. Future studies investigating the longitudinal mechanisms underlying the effects described in the conceptual model of Stodden et al. (2008) should be extended to include process- as well as product-oriented assessments and the perception of MC and HRF.

Sport and Exercise Psychology

Currently felt and anticipated emotions predict future physical activity: An examination of pride and shame

Jenna Gilchrist, University of Toronto, David E. Conroy, The Pennsylvania State University; Catherine M. Sabiston, University of Toronto

Emotions play a critical role in helping people adapt their behavior to changing relational circumstances. Anticipated emotions "predicting how one will feel in the future" may also guide behavior based on the desired emotional outcomes individuals expect from engaging in a behaviour. Participants (N = 158, 76% women; Mage = 35.51, SD = 10.29) training for a marathon/half-marathon completed a weekly online questionnaire after five training runs immediately preceding a race. Each week participants reported their anticipated pride and shame if they met and did not meet their goals for the race, respectively, the intensity of pride and shame experienced during their run, and their training behavior that week.

Multilevel models were estimated to test hypothesized associations between experienced and anticipated emotions and future training behavior after controlling for age, gender, and temporal proximity of the race. Time spent training increased following weeks when participants reported experiencing less pride than usual ($\beta = -21.12$, $SE = 7.11$, $t(320) = -2.97$, $p < .05$) and was greater for participants who usually reported experiencing more shame than others ($\beta = 79.61$, $SE = 34.14$, $t(151) = 2.33$, $p < .05$). Participants reported putting forth more effort towards their training following weeks when they felt less pride than usual ($\beta = -0.34$, $SE = 0.09$, $t(319) = -3.88$, $p < .05$) and was greater for participants who usually reported experiencing more pride than others ($\beta = 0.31$, $SE = 0.08$, $t(151) = 3.65$, $p < .05$). Lastly, individuals put forth more effort towards training following weeks when they anticipated experiencing less than the maximum amount of pride when meeting their goal for the race than others ($\beta = -.46$, $SE = 0.22$, $t(151) = -2.11$, $p < .05$). These results extend recent conclusions that affective responses predict future physical activity by highlighting the differential roles of two discrete emotions in that process.

Preconference Workshops

Exercise-Is-Medicine meets Evidence-Based-Medicine:
Learning to critically appraise Randomized Controlled Trials (RCTs) in the time of bias
Panteleimon Ekkekakis, Iowa State University

In several countries, exercise and physical activity are now included in clinical practice guidelines for the prevention and treatment of a wide range of diseases and types of disability. Indeed, the goal of the global Exercise-is-Medicine initiative is to further promote the implementation of exercise and physical activity in clinical practice. What is perhaps not yet fully appreciated is that the push to introduce a non-commercial option could force a redistribution of market shares, with substantial economic ramifications for the commercial entities benefiting from current options. Because clinical practice guidelines are developed following the model of Evidence-Based Medicine (EBM), these economic factors may directly impact the quality and integrity of clinical research. This pre-conference workshop will introduce attendees to some of the common mechanisms by which bias can influence the research process. The focus will be on depression, the leading cause of disability in high-income countries and one of the costliest disorders in the world. The interactive presentation will be based on several examples of published RCTs examining the effects of exercise on depression. The scope will cover participant inclusion/exclusion criteria, statistical power calculations, experimental designs, intervention development, treatment cross-contamination, outcome measurement, statistical analysis, data interpretation, and public dissemination.

Seeing the forest and the trees: Theoretical and practical issues in sport expertise
Joseph Baker, University of York; Nicola Hodges, University of British Columbia

This event is organized around the themes of cognitive-perceptual sport expertise and applied skill acquisition. It will involve a keynote presentation from Professor Jocelyn Faubert (Essilor - NSERC Chair, Université de Montréal) who will speak about his experiences using the neurotracker approach to test and train for perceptual-cognitive skills in sports. There will be 3 open-talk sessions throughout the day on “Deliberate practice & “talent” identification,” “Perceptual-cognitive skills,” and “Issues in sport expertise”. These talks will involves speakers from around the globe, including Australia, Canada, Iceland, Ireland, Germany, The Netherlands, UK, and USA. These presentations will be 15-minute talks that may be idea- or data-based with implications for sports-application. Attendees at this event include both academics and trainees as well as sport practitioners working for and in association with the Institut National du Sport du Québec.

Thursday, June 16

Special Symposium

NASPSPA Special Symposium: Honoring Richard A. Schmidt

Symposium Organizer: Gabriele Wulf, University of Nevada, Las Vegas
Symposium Discussant: Timothy D. Lee, McMaster University

Dr. Richard A. Schmidt died on October 1, 2015, at the age of 74. He was perhaps the most renowned scholar in the field of motor learning and control. Dick Schmidt made significant contributions to NASPSPA. He served as the Society's president from 1977-1978. In addition, he served on, or chaired, NASPSPA program committees during the early years of NASPSPA. In 1992, Schmidt received NASPSPA's most prestigious award, the Distinguished Scholar Award, for his outstanding scholarly achievements. Twenty years later he was the recipient of another major NASPSPA award, the President's Award, which was presented to him in 2013. In this symposium, we will reflect upon some of Schmidt's theoretical and empirical contributions to motor control and learning, and the broad application of his work in several related fields. The symposium includes five presentations by former students, post-docs, and collaborators of Schmidt's. Howard Zelaznik will discuss new findings related to impulse- variability theory (Schmidt, Zelaznik, Hawkins, Frank & Quinn, 1979) and the speed accuracy trade-off. Stephan Swinnen will report on neural evidence in support of the guidance hypothesis (Salmoni, Schmidt, & Walter, 1984). An overview of Schmidt's contributions to human factors, including his investigations into unintended accelerations of vehicles, will be given by Doug Young. Carolee Winstein's presentation will focus on Schmidt's contributions to the science of physical therapy and clinical rehabilitation. Gabriele Wulf will reflect upon the impact of schema theory (Schmidt, 1975), some of the challenges it faced, as well as new theoretical developments in the field of motor learning. The symposium discussant, Tim Lee, will provide reactions and final thoughts on Dr. Schmidt's legacy.

The linear speed accuracy trade-off (Schmidt's Law): Is it related to Fitts' Law?
Zelaznik, Howard N., Purdue University

Schema theory (Schmidt, 1975) was just published and a cottage industry of variability of practice studies was born. Richard A. Schmidt was a bit restless and was looking for a new line of research. At a graduate seminar Jim Frank and Howard Zelaznik presented concerns about the Crossman and Goodeve (1963, 1983) explanation for Fitts' Law. Dick Schmidt along with his students then developed a revolutionary idea: Variability in the motor programming process was related to the force characteristics of a class of movements. Thus, impulse variability theory for the speed accuracy trade-off was born. The impact of this work is described. The status of the theory is reviewed, a newer set of theories by Meyer and colleagues is presented. Finally, new evidence is presented that I take as support for the independence of Fitts' and Schmidt's Laws.

Schmidt's guidance hypothesis of information feedback: A neural account
Swinnen, Stephan P., University of Leuven

In the early eighties, Schmidt and coworkers proposed the "guidance hypothesis of information feedback." This hypothesis implies that provision of information feedback can be helpful because it guides the learner to the proper action. Nevertheless, this guidance property can also be misleading when the learner becomes too dependent on this source of information, such that future performance in the absence of augmented feedback is hampered. This work inspired us in the early days to conduct various studies on knowledge of results under Dick Schmidt's supervision in

order to reveal its guidance properties. Another line of research was initiated in collaboration with Chuck Walter and Tim Lee to explore sources of online information feedback for complex (bimanual) coordination tasks. This work led to the use of Lissajous figures in which the angular displacements of the left and right upper limb are plotted against each other such that the resulting cursor movement on the screen provides information about the coordination between both limbs. Two lines of evidence will be discussed that provide neural support for Schmidt's legacy. On the one hand, I will discuss evidence that performance of coordination patterns in the presence and absence of augmented feedback relies on distinct neural pathways. On the other hand, I will demonstrate that, following the removal of augmented feedback, the learner will continue to recruit brain areas that are specialized for augmented feedback processing. This is indicative of a continuing dependence on brain areas involved in sensory processing even though the augmented feedback itself has been removed. Overall, these data provide compelling evidence for a "neural network account" of the guidance hypothesis of information feedback. Optimal training implies that a balance between the positive and negative effects of augmented feedback is considered and that dependence on augmented feedback is reduced.

Dr. Schmidt's contributions to human factors

Young, Doug E., Exponent

Over the course of his professional career, Dr. Schmidt provided extensive insight about an array of real-world issues to various agencies and institutions, such as prescribing training principles for military training at the request of the Department of Defense. As part of his consulting work, he became known as the foremost expert in sudden acceleration incidents when he applied motor control concepts to explain the role of driver error in these highly scrutinized vehicular accidents. The seminal 1989 paper published in Human Factors highlighted his explanation of a phenomenon in which operators inadvertently depressed the accelerator pedal when the brake was intended. Subsequent to this work, Dr. Schmidt continued to investigate issues related to restraint usage, in-vehicle ergonomics, and driver performance. His work was supported by various automotive manufacturers and relied on by government agencies, such as the National Highway Traffic Safety Administration and National Transportation Safety Board. In addition to his contributions to transportation human factors, Dr. Schmidt has published numerous empirical papers in various applied journals as well as chapters in the International Encyclopedia of Ergonomics and Human Factors.

Richard Schmidt's contributions to physical therapy and rehabilitation science

Winstein, Carolee J., University of Southern California

Academia and the field of motor behavior lost one of its greatest intellectual leaders with the passing of Richard Allen Schmidt (1941-2015). Although Dick is renowned for his profound impact on research in motor control and learning, less known are his contributions to the clinical profession of physical therapy and the broader field of rehabilitation science. In 1983, I had the good fortune to join Dick's laboratory at the University of California at Los Angeles as a graduate student after completing a 10-year professional career as a physical therapist at Rancho Los Amigos National Rehabilitation Hospital where I specialized in neurological rehabilitation. Dick's contributions to rehabilitation science were motivated initially through academic pursuits to apply new knowledge about motor learning concerning practice schedules and the use of extrinsic feedback to facilitate recovery through rehabilitative interventions. Towards the end of his life, in spite of personal health challenges that gradually robbed him of his physical capabilities, Dick's deep curiosity, sense of humor, and motivation to educate his physical therapists and physicians drove him to use his own self-observations as a platform for clinical research in motor control and learning. This presentation will chronicle Dick's professional and personal contributions to the empirical and theoretical foundations of physical therapy specifically and rehabilitation science more generally.

Schema theory - and what we have learned over the past four decades

Wulf, Gabriele, University of Nevada, Las Vegas

Richard A. Schmidt's (1975) schema theory of discrete motor learning is a citation classic. It was Dick Schmidt's first major contribution to the field of motor learning. As any important theory, it saw much support for its predictions, but there was also no shortage of challenges. Thus, the theory fulfilled its role by providing a significant impetus to the field. As a doctoral student in Germany, I became fascinated by schema theory and completed a dissertation that examined issues related to the theory. I was fortunate enough to be able to later join Dick's lab at UCLA as a post-doc. In this presentation, I will discuss some of the early challenges to schema theory, based on findings related to contextual interference (e.g., Lee, Magill, & Weeks, 1985) and the guidance hypothesis (Salmoni, Schmidt, & Walter 1984), that we tackled in his lab. Moreover, I will highlight some more recent empirical and theoretical developments in the area of motor learning. I will touch upon a new theory that attempts to account for what is currently known about motor skill learning. The theory would not have been possible without the scientific training and guidance Dick Schmidt provided.

Sport and Exercise Psychology

Global perspectives about effective coach leadership
Organizer: Gordon A. Bloom, McGill University
Discussant: Martin Camire, University of Ottawa

Effective coaching is a vital component that contributes to the achievement, personal satisfaction, and enhanced well-being of athletes (Bennie & O'Connor, 2011; Mallett, 2005; Vallée & Bloom, 2005; Werthner & Trudel, 2006). Moreover, successful coaches at the youth and elite levels have adjusted their behaviors to meet contextual demands in order to maximize athlete satisfaction and performance (Mallett, Emmett, & Rynne, 2015; Camiré & Trudel, in press; Caron, Bloom, & Bennie, 2015). Despite this, rarely have cross-cultural comparisons from several global regions been made with respect to effective coaching leadership. The purpose of this symposium is to provide global perspectives about effective coach leadership behaviors that are designed to maximize athlete satisfaction and performance. Each presenter will summarize evidence-based research from around the globe that adopted various theoretical backgrounds and qualitative and quantitative research approaches to explain how to optimize both coach leadership and effectiveness in special contexts. Presentations one and two will focus on aspects of coach leadership in the Indigenous context in Australia and the Paralympic setting in Canada. Presentation three will examine the sources of coaching knowledge of Chinese artistic and rhythmic gymnastics coaches. Presentation four will examine high performance coaches in the Australian context. The presenters have extensive research and consulting experience with coaches and athletes across multiple sport settings within different countries and cultures.

Canadian Paralympic coaches' knowledge and behaviors
Bloom, Gordon A., McGill University

Sport can help individuals with a disability reduce isolation by providing a means of positive social interaction and integration. Physical activity also helps individuals with a disability shift their focus from impairment to accomplishment by highlighting their physical well-being, pain control, and perceptions of health and independence (Carvalho & Farkas, 2005; Goodwin & Compton, 2004). The highest level of sport competition for individuals with a physical disability is the Paralympics. While there is much research on Olympic athletes, the same cannot be said for Paralympic athletes (Burkett, 2013), and even fewer investigations on coaches of elite athletes with a disability (Rangeon, Gilbert, & Bruner, 2012). This presentation will share the cumulative results of several empirical studies that have examined the knowledge and behaviors of Paralympic coaches in Canada (Caron, Bloom, Loughead, & Hoffmann, in press; Cregan, Bloom, & Reid, 2007; Falcão, Bloom, & Loughead, 2015; Tawse, Bloom, Sabiston, & Reid, 2012). Criterion-based sampling (Sparkes & Smith, 2014) was used to select participants for each study. All the participants were identified by a panel that included current and former members of the Canadian Paralympic Coaches Council. All the data was acquired using semi-structured interviews and were analyzed using thematic analysis (Braun & Clarke, 2006, 2013). The content in this presentation will offer practical leadership skills for coaching athletes with a disability such as promoting independence, providing appropriate feedback, setting realistic goals, and periodization in training. Additionally, the presentation will provide examples of how coaches have adapted their strategies and knowledge specific to the coaching context regarding accessibility, transportation, and managing athlete impairments. These results should lead to more positive training and competitive environments for some of the world's most talented athletes. The findings may be used to improve the coaching skills of individuals who are working within disability sport worldwide.

Facilitating opportunity and reducing barriers in sports coaching: A qualitative study with indigenous Australian sport coaches
Bennie, Andrew, The University of Western Sydney; Apoifis, Nicholas, University of New South Wales; Caron, Jeffrey G., McGill University

Indigenous Australians have high sport participation and physical activity rates across various age groups. However, there are only 173 full time sport coaches from an Indigenous background compared to 21,133 full-time coaches from non-Indigenous backgrounds which is less than 1% across all sports (ABS, 2012). While the imbalance is concerning, this presents an opportunity for translating the high athletic participation rates to coaching roles.

Interestingly, research in Australian sport has focused on Indigenous athletes, communities and sporting organizations, but none have explored the perspectives of Indigenous coaches. This is the first study to solely explore Indigenous sport coaching as a research topic. The main purpose of this project was to investigate Indigenous Australian sport coaches' perceptions about the facilitators and barriers related to obtaining and progressing in coaching roles. A Social Ecological Framework was used to explore the influences on Indigenous Australian sport coaching opportunities. Qualitative interviews were used to capture detailed and personalized accounts about Indigenous sport coaching. The results showed that this sample of coaches were motivated individuals who enjoyed coaching and sought out additional knowledge to improve their coaching and progress in coaching roles. Participants harbored a desire to give back to athletes and extend their personal and professional relationships within coaching. Coaches expressed the need for more cultural competency training, mentoring and support in their respective coaching roles and the participants cited the lack of Indigenous voice as barriers within sports coaching. The findings from this research may be used to inform coach education programs about individual, interpersonal, organizational, and societal factors that influence the representation of Indigenous people in sport coaching roles.

Actual and ideal sources of coaching knowledge of Chinese coaches

Trudel, Pierre, University of Ottawa; He, Chao, Jiangsu Second Normal University

Due to globalization and advances in technology, knowledge is moving faster than ever across the world. In sport, coaches have the opportunity to move from country to country to join different national coaching teams more than ever before (Wang & Calloway, 2011). From a coach leadership perspective, it becomes important to gain a better understanding of the potential differences in the coaches' sources of knowledge if we want to help them adapt to new coaching and athlete development environments. Using the results of studies conducted by Western researchers (e.g., MacDonald, Beck, Erickson, & Côté, 2014; Werthner & Trudel, 2009), a questionnaire was developed to examine the actual and ideal sources of coaching knowledge of Chinese artistic and rhythmic gymnastics coaches. 80 coaches working with athletes from different coaching contexts (recreational = 6; developmental =35; elite = 39) from different parts of China completed the questionnaire and 16 of these were interviewed. Data show these coaches acquired their knowledge (actual) mainly through 'being an athlete' and by 'having a mentor' but ideally they would have preferred to have a better balance between these two sources and formal learning situations (courses, conferences). Another unique finding was that Chinese coaches do not consider the Internet as an important source of their knowledge (actual and ideal), which might be attributed to differences with the English language. While it might be common sense to say that coaches from different countries do not have the same learning and leadership opportunities, identifying and specifying preferred learning sources is critical for coach educators from around the globe.

Chinese high performance diving coaches in Diving Australia: A case study of workplace learning

Mallett, Clifford, Tao, Yi-Che, Rynne, Steven, The University of Queensland

The employment of foreign coaches has become a globalized phenomenon (Falcous & Maguire, 2005; Maguire, 1999). The primary reason for the employment of highly successful foreign coaches is the pursuit of international sporting success. Nonetheless, the globalization of coaching has presented many challenges for both foreign coaches and the national sporting organisations with whom they are contracted (Whelan, 2008). Two interrelated issues for foreign coaches is the need for assimilation into a different culture (Livingston, Tirone, Smith, & Miller, 2008) and the dynamism of high performance coaching as a vocation (Mallett, 2010). Of particular interest, are how these challenges shape coach learning and practice (Rynne et al., 2006, 2010; Tao, 2013). We drew upon Billett's (2006) notion of relational interdependence (RI), to enable a broad consideration of the relationship between individual agency and the relevant affordances in the workplace (Rynne et al., 2006, 2010; Tao, 2013). This case study focused on Chinese diving coaches and staff employed within Diving Australia (DA). Multiple data sets (i.e., observations, three structured interviews, twenty-three semi-structured interviews, one focus group, and related document collection) were collected from three Chinese high performance diving coaches, four administrators, four divers, and three paraprofessionals. Using thematic analysis, five major themes were identified: (a) contribution of premediate experiences to professional knowledge and skills; (b) socio-cultural challenges; (c) partial cultural assimilation promoted collaboration, learning, and improved performance; (d) differential interplay of coaches' agency and workplace affordances in shaping learning; and (e) the RI between coach agency and DA's affordances were found to be person-dependent, hierarchical, cyclical, cooperative, and dynamic.

Coaching and Group Dynamics in Sports
Organizer: Ian Boardley, University of Birmingham
Discussant: Daniel Gould, Michigan State University

Authentic leadership in sport: Effects on athletes' satisfaction, commitment and enjoyment and the mediating role of autonomy and trust
Bandura, Comille T., Malloy, Ella R., Kavussanu, Maria, University of Birmingham

Although coaching and group dynamics can be viewed as distinct areas of sport research, these two research domains often converge. More specifically, both of these fields of research investigate key social processes in sport, and coaches can exert influence on the athletes they coach through processes investigated in group dynamics research. As such, it is important researchers continue to further our understanding of: (a) factors that influence coaching and group processes, (b) the interrelationships between coach behavior and group processes, and (c) outcomes stemming from coaching and group processes. Accordingly, the overriding objective of the present symposium is to showcase these two important fields of research and the connections between them. To address this objective, this symposium incorporates five presentations relevant to sport coaching and/or group dynamics. The first presents a study investigating the hierarchical effects of transformational coaching behaviors on athletes' social identities in youth ice hockey. The second applies transformational leadership theory to underpin the development and validation of an indirect measure of coaches' automatic transformational leader integrity attitudes. The third examines whether authentic leadership predicts athlete satisfaction, commitment and enjoyment in team sport athletes, and whether any effects are mediated by perceived autonomy and trust. The fourth presents research investigating the multilevel effects of intrateam moral behavior on task and social cohesion in youth ice hockey. The final talk presents an analysis of qualitative data from an evaluation of an online coach-education program to investigate the impact of the program on coaches' knowledge, attitudes and behaviors. Overall, the research presented in the current symposium contributes knowledge on a wide range of topics relevant to coaching and/or group dynamics in sport, and highlights important areas of convergence between these two research domains.

Transformational coaching behaviors and social identity in youth sport
Bruner, Mark, Nipissing; Tunnridge, Jennifer, Vierimaa, Matthew, Cote, Jean, Queens University

Previous studies in organizational psychology have proposed that social identity may be a key mechanism through which transformational leadership positively influences follower outcomes (Huang, 2013; Tsu & Chiu, 2014). To date, however, minimal attention has been devoted to understanding how perceived transformational leadership behaviors influence social identity in sport. The purpose of this study was to investigate the hierarchical effects of transformational coaching behaviors on athletes' social identities in youth sport. Male and female adolescent athletes (N = 364) from 28 competitive youth ice hockey teams completed measures of transformational leadership (idealized influence, inspirational motivation, intellectual stimulation, and individual consideration; Beauchamp et al., 2010) and social identity (ingroup ties, cognitive centrality, ingroup affect; Bruner et al., 2014). A multilevel analysis was performed for each social identity subscale in order to account for the nested nature of the data. Transformational coaching behaviors accounted for variance at both the individual and team levels, ranging from 7% (ingroup ties) to 24% (cognitive centrality). At the individual level, higher perceptions of coaches' use of inspirational motivation predicted greater ingroup ties and cognitive centrality. Higher perceptions of intellectual stimulation also predicted greater cognitive centrality. At the group level, higher perceptions of intellectual stimulation predicted greater ingroup ties, cognitive centrality, and ingroup affect, while higher perceptions of idealized influence negatively predicted cognitive centrality and ingroup affect. Overall, the results emphasize the influential role that transformational coaching behaviors can have on athletes' social identities in youth sport. Implications for theory development and practical applications are presented.

Development and initial validation of an indirect measure of automatic transformational leader integrity
Mills, John P., Chichester; Boardley, Ian D., University of Birmingham

Research examining the integrity motives of leaders is lacking (Christie, Turner, & Barling, 2011). Until recently, scholars interested in leader integrity have been bound by methodological limitations leading to an overreliance on either self- or other-report approaches. This may be problematic when one considers leaders lacking integrity are

often deceptive and manipulative (Bass & Steidlmeier, 1999). Applying Bass and Steidlmeier's (1999) transformational leadership framework, the present study addresses this issue by developing a measure of automatic transformational leader integrity (i.e., The Transformational Leader Integrity Implicit Association Test; TLI-IAT) across three studies. Studies 1 (n = 64) and 2 (n = 44) examined the reliability, convergent validity (through association with a self-report measure of perceived leader integrity [PLIS; Craig & Gustafson, 1998]) and discriminant validity (across organizational types) of the new measure. Findings demonstrated the TLI-IAT: (a) was reliable over the short (ICC [2,1] = .87, 95 CI [.76,.93]) and long (ICC [2,1] = .78, 95 CI [.47,.91]) term, (b) converged positively with the PLIS ($r = .28$, $p < .05$) and (c) effectively discriminated between the ethical motives of leaders across organizational types ($F(3,59) = 6.22$, $p < .05$, partial eta2 = .24). Study 3 examined whether coaches' (n = 32) TLI-IAT scores predicted their players' (n = 133) self-reported commitment (Scanlan et al., 1993) more effectively than player reported ratings of their coach's leader integrity attitudes (PLIS; Craig & Gustafson, 1998). Regression analyses (ΔF [5, 24] = 4.19, $p < .05$, $\Delta R2 = .17$) indicated coaches' TLI-IAT scores positively predicted player commitment ($B = 2.46$, SE B = 0.91, $\beta = .44$, $t = 2.69$, $p < .05$), whereas player reports of leader integrity did not ($B = 0.44$, SE B = 2.15, $\beta = .03$, $t = 0.20$, $p > .05$). Overall, the findings from the three studies suggest the TLI-IAT is a valid and reliable measure of coaches' automatic transformational leader integrity attitudes.

Moral behaviour and team cohesion in youth sport: A multilevel analysis

Vierimaa, Matthew, Queens University; Bruner, Mark, University of Nipissing; Turnnidge, Jennifer, Cote, Jean, Queens University

Recent research has established that team cohesion is a prominent group construct that is associated with positive developmental experiences in youth sport (Taylor & Bruner, 2012). Given the potential implications of team cohesion on youth's development in sport, it is critical to understand the factors that can contribute to higher levels of cohesion in sport teams. One important factor may be youths' moral behaviour toward teammates, which previous research has linked with salient group outcomes such as social identity (Bruner, Boardley, & Cote, 2014). Thus, the purpose of this study was to investigate the effects of perceived moral behaviour on team cohesion in youth sport. A sample of adolescent competitive ice hockey players (N = 346) from 28 teams completed measures of perceived moral behaviour (Prosocial and Antisocial Behavior Scale for Sport, PABSS; Kavussanu & Boardley, 2009) and team cohesion (Youth Sport Environment Questionnaire, YSEQ; Eys et al., 2009). Multilevel modeling was used to account for the nested nature of the data. A separate multilevel analysis was performed for each YSEQ subscale (task cohesion and social cohesion) using the two teammate subscales of the PABSS (prosocial behaviour toward teammates and antisocial behaviour toward teammates) as predictors. At the individual level, both higher prosocial behaviour and lower antisocial behaviour toward teammates predicted higher levels of task and social cohesion. At the group level, higher prosocial behaviour toward teammates predicted higher task and social cohesion, while lower antisocial behaviour predicted higher task cohesion. Overall, prosocial and antisocial behaviour toward teammates and opponents accounted for 24-25% of the variance in team cohesion. These findings suggest that youth athletes' moral behaviour towards teammates closely relate to their perceptions of team cohesion. Implications of these findings for research and practice will be presented.

Evaluation of a nationwide, online coach education program: self-reported changes in coaches' knowledge, attitudes, and behaviors

Driska, Andrew, Michigan State University

The recent proliferation of formal online coach education programs necessitates evaluating the efficacy of these programs. As part of a utilization-focused evaluation (Patton, 2011) of a nationwide, online coach education program, a systematic sample of 21 coaches who participated in the program were interviewed to attain their general perceptions of the course, along with self-reported changes to knowledge, attitudes, and behaviors. Abductive analysis (Patton, 2002) allowed for a deductive exploration of anticipated themes, while also allowing for unforeseen themes to emerge through inductive analysis. Participants overwhelmingly (n = 19) reported a favorable impression of the course, which is particularly significant given there was widespread resistance to the previous version of this program. The most common (n = 14) change in knowledge came from watching videos of coaches and swimmers model skills, drills, pedagogy, and management. A smaller number of coaches reported an increase in their awareness of appropriate channels of development and age-appropriate practices (n = 8), and an increased knowledge of practice and seasonal planning (n = 7). Seven coaches indicated that the course had reaffirmed their knowledge of the sport, thus building their confidence to coach. With respect to attitudes, almost half of the sample

(n = 10) reported that the course increased their value for developmentally-appropriate training and practices and had increased their conscientiousness (defined as reflective thought, concern, and rationale for actions). With respect to behaviors, the course's most pervasive effects were an increased use of developmentally appropriate training practices (n = 12), incorporating fun into practices (n = 14), and use of either a goal-setting or milestones recognition program (n = 8). Findings support the efficacy of this online program to deliver knowledge, facilitate its implementation, and shape attitudes and behaviors, particularly with respect to aspects of planning, pedagogy, and appropriate athlete development.

Motor Development

Underlying Psychological Mechanisms of Motor Competence

Organizer: An De Meester, Ghent University & David Stodden, University of South Carolina
Discussant: Maureen Weiss, University of Minnesota

Significant attention has been paid to the positive relationship between children's motor competence (MC) and their physical activity (PA) levels (e.g., Robinson et al., 2015; Holfelder & Schott, 2014; Logan et al., 2015). However, far less attention has been paid to underlying psychological mechanisms (e.g., motivation) that might influence children's MC and accordingly their PA. In the context of developing interventions that aim to improve children's MC and/or PA, it is important to gain more insight in how various psychological mechanisms relate to the development of MC as well as PA. As children's and adolescents' perceived competence (PC) is not always aligned with their MC, both constructs and their dynamic relationship are also addressed in this symposium. The research questions are addressed by a diverse range of study designs and statistical approaches (i.e., person- & variable-centred analyses) that start from different theoretical frameworks. The first two presentations are based on the framework of Self-Determination Theory (Ryan and Deci, 2007) and use person-centred profile analyses. The first presentation examines how motivational climate profiles (based on levels of perceived mastery & performance climate) relate to female adolescents' PC and their well-being (e.g., self-esteem), while the second presentation explores how MC profiles (based on MC & PC) are related to sports- motivation and global self-worth among children. The last two presentations use variable-centred analyses to approach the concept of MC. The third presentation focuses on the (mis)alignment between boys' and girls' MC and PC, and explores how PA-related factors contribute to this (mis)alignment. The fourth presentation examines how physical educators' emotional and physical support might improve young children's MC and their executive functions (e.g., working memory). The discussant will focus on the importance of gaining more insight on the underlying role of psychological mechanisms in the relationship between MC and PA, and will discuss recommendations for future research.

Configurations of actual and perceived motor competence among children: Associations with motivation for sports and global self-worth

Bardid, Farid, De Meester, An, Tallir, Isabel, Cardon, Greet, Lenoir, Matthieu, Haerens, Leen, Ghent University

Objectives: Positive relationships among perceived motor competence (PMC), motivation for sports and global self-worth have been identified in previous studies by means of variable-centered analyses. However, it remains unclear how actual motor competence (AMC) relates to both correlates. To gain more insight into the role of both AMC and PMC in terms of motivation and self-worth, the present used a person-centered approach aiming at a) investigating if different combinations of AMC and PMC exist, and b) exploring how children with different types of MC-based profiles might differ in terms of quality of motivation for sports and global self-worth. Methods: 161 children (40% boys; age=8.82"0.66y) completed validated questionnaires to assess PMC and global self-worth (SPPC), and motivation for sports (BREQ). Children's AMC was assessed with the KTK. Person- centered analyses were used to identify different MC- based clusters. Multilevel regression analyses were conducted to investigate differences between clusters in terms of motivation and global self-worth. Results: Four clusters could be retained: two groups were characterized by relatively high or low levels of both AMC and PMC (i.e. high-high, low-low), in addition we also identified children with relatively high AMC but relatively low PMC (high-low), and children with relatively low AMC but relatively high PMC (low-high). Children with relatively low PMC displayed significantly lower levels of autonomous motivation for sports ($\beta 0$=3.88; SE=.15 and $\beta 0$=4.07; SE=.15 respectively) than children with relatively high PMC; ($\beta 0$=4.55; SE=.12 and $\beta 0$=4.43, SE=.12), independent from whether these low levels of PMC were combined with high levels of AMC or not. A similar result was found for global self-worth. Conclusion: The results show that children with low PMC are less motivated for sports and have a lower global self-worth than

children with high PMC, even if they have high AMC. These findings emphasize that developing children's PMC seems crucial to stimulate their motivation for sports and their global self-worth.

The role of scaffolding in physical activity in development of motor and cognitive skills.

Tortella, Patrizia, Fumagalli, Guido, University of 37100 Verona

Introduction A lot of children don"t have the basic motor skills to engage successfully in sport and physical activity (PA). Structured activity is necessary to develop actual motor competence (AMC), particularly during early childhood. PA may also contribute to developing executive functions (EF), which are important for every aspect of life. What is the role of emotional and physical scaffold in improving AMC and EF in five year old children" Methods We studied 5y old children (159 children of Treviso, northern Italy). Forty-nine children attended a playground for 10 times, once a week, for 1 hour training, each time, following a controlled program of structured physical activity and free play, 51 children attended for the same time playing free play, only and 59 children never attended the playground. Children participating in structured activity were scaffold by a physical educator, in a standardized emotional and/or physical way, when required. We tested the children pre and post training period on AMC (time of execution and n of errors on a difficult task) and on executive functions (Day/night test). Results Children participating in structured activity improved AMC (34,7% - 100/100) and EF (2.20 " 0.44**) compared to children in the free play group (MS 15,6% - 62,7/100; EF 3.55 " 0.63) and the control group (MS 28,8% - 77,9/100; EF 2.83 " 0.49*). In children practicing structured activity the EFs improved significantly in those not able to perform the difficult task at pretest(but succeeded at post test, after physical scaffold; 1.23 " 0.34**), while physical and emotional scaffold gave improvement in children able to perform the difficult task at pre and post test (1.42 " 0.29*). Conclusions: The results encourage more research relative to different kinds of educator-mediated experiences, suggesting that successful experiences promoted by scaffolding encourage autonomous child training expanding perceived motor competence, promoting the development of AMC and cognitive skills.

When children's perceived and actual motor competence mismatch: Sport participation and gender differences

Masci, Ilaria, Mazzoli, Emiliano, Forte, Roberta, Forte, Giuseppe, Pesce, Caterina, Italian University Sport and Movement "Foro Italico"

Perceived motor competence (PMC) is a mechanism explaining why actual motor competence (AMC) in childhood influences physical activity (PA) levels later in life. Thus to design PA for health, it is relevant to understand what factors influence the relationship between PMC and AMC. This pilot study examined (a) the relationship between children's PMC and objectively assessed AMC and (b) the role played by sex and PA-related factors (sport practice and PA enjoyment) in determining mismatches between PMC and AMC. Ninety-six children aged 7,5"1,2 years performed the Tests of Gross Motor Development-2 (TGMD-2, with a subsample of 52 children also wearing inertial sensor devices for objective measurement of running and throwing) and completed the Pictorial Scale of Perceived Movement Skill Competence. Scores of PMC (locomotor and object control) were regressed on TGMD data. Cases deviating > 1 SD from regression-predicted values (24 for locomotor and 28 for object control skills) were divided as to whether children under- or overestimated their AMC. Then, it was assessed whether under- and over-estimators differed in sex ($\chi 2$ test), amount of sport practice and/or PA enjoyment (t-tests). Locomotor and throwing performance predicted 6% and 7% of perceived locomotor and object control competence, respectively. (a) Sex differences emerged, with most girls underestimating and most boys overestimating their perceived object control competence. (b) Over-estimators of locomotor competence practiced twice as much sport as under-estimators (3 vs. 1.5 h/week) and (c) showed higher values of trunk angular velocity around the cephalo-caudal axis. Results suggest: (a) the need for specific motivation strategies to ensure a skill-appropriate enhancement of perceived skill in girls; (b) the relevance of PA/sport practice per se for children to feel skilled; (c) the added value of quantitative assessment to understand aspects of PMC that are not aligned with observational data.

Motivational climate profiles, psychological need satisfaction, and well-being among female adolescent athletes

Kipp, Lindsay E., Texas State University; Bolter, Nicole D., San Francisco State Univeristy; Phillips, Alison C., University of Minnesota

Girls participating in aesthetic sports like gymnastics and figure skating may be at risk for disordered eating and low self-esteem (Monsma et al., 2006). According to self-determination theory (Ryan & Deci, 2007), the social context (e.g., coach-created climate) can impact youths' well-being (e.g., self-esteem, eating patterns) through mediation of three psychological needs: perceived competence, autonomy, and relatedness. Research has shown that a coach-created mastery climate is associated with greater psychological need satisfaction and well-being, while a performance climate has shown inconsistent relationships with these outcomes (Kipp & Weiss, 2015; Quested & Duda, 2010). Our purpose was to examine motivational climate profiles to better understand whether the combination of higher or lower levels of each climate type differentially relate to needs satisfaction, self-esteem, and disordered eating. Female gymnasts, divers, and figure skaters ages 10-17 (N=109; Mage=12.5) completed a survey to assess perceptions of the coach- created climate, perceived sport competence, autonomy, relatedness, self-esteem, disordered eating, and physical maturity. Two climate profiles emerged: (1) HIGH/LOW included girls who perceived high levels of a mastery and low levels of a performance climate, and (2) MODERATE included girls who perceived moderate levels of each climate type. Controlling for physical maturity, a MANCOVA revealed that the two climate profiles significantly differed on the set of outcome variables. The HIGH/LOW group showed significantly higher levels of perceived competence, autonomy, and relatedness compared to the MODERATE group. Physical maturity also explained a significant amount of variance in perceived competence, self-esteem, and disordered eating"post-pubertal girls reported lower sport ability and self-esteem and greater disordered eating. Thus, both physical maturity and the social context were associated with girls' perceived competence in their sport. Findings suggest ways for coaches to enhance athletes' needs satisfaction and well- being.

Motor Learning and Control

Skilled Anticipation: The role of contextual sources of information

Organizers: Rouwen Canal-Bruland & David L. Mann; Vrije Universiteit Amsterdam

Over the last four decades, research examining skilled anticipatory behavior has focused almost exclusively on the usefulness of kinematic sources of information for skilled anticipation in sport. This symposium will discuss what we argue to be a rather neglected yet probably very important aspect of skilled anticipation that is the influence of broader situational or contextual (non-kinematic) sources of information. As early as in the late 1970s researchers such as Luc Proteau and colleagues identified that anticipatory behavior may at least in part be informed by non-kinematic information independent of an observed movement. However in 2001, it was Abernethy and colleagues who – more than 20 years later – showed that non-kinematic information that they coined situational probabilities could be used to anticipate action outcomes in the absence of any movement information from an opponent (in that case by evaluating the court position of the opponent in squash). Since then, only recently have a handful of researchers started to systematically examine the contribution of probabilistic information to anticipatory judgements. The aim of this symposium will be to showcase recent studies that seek to address the relative paucity of work addressing this issue. The symposium will start with a historical review by one of the key contributors to the early work on the role of contextual information on skilled anticipation (Luc Proteau) and will be followed by four presentations that identify key sources of contextual information, and reveal how they help to shape the superior anticipatory skill of elite athletes.

I can guess your next move … what will I do?
Proteau, Luc, Université de Montréal

You are facing an opponent in a context in which you should react both quickly and accurately. If you are an expert, you are likely to anticipate the next move of your opponent with some level of certainty. In the mid- to late 80's, we wanted to determine how you would use your good knowledge of the game and of your opponent to shorten the time required to complete your next move. In this symposium, I will review this early work, which was largely published in French. Typically, participants took part in a two-choice reaction- and movement time task. The participants' task was to move a trolley for approximately 30 cm in the direction indicated by the stimuli. Prior to each trial, the participants were informed of the probability of occurrence of the two stimuli and of the time allotted to them to complete their response, which could be long, medium, or short. The results of a series of experiments showed that participants: (a) are reluctant to shorten their reaction time to increase the likelihood of completing their movement within the allotted time; (b) accept to make postural adjustments in order to reduce their movement time, (c) prefer a mixed type of preparation whenever possible, (d) use a response strategy that appears to be dictated by their subjective evaluation of the probability of occurrence of the two stimuli rather than by the objective probability of occurrence of these stimuli.

The use of intrinsic and extrinsic contextual information in sports: Performance, presentation and pressure effects
Gray, Rob; Arizona State University

It has been frequently proposed that athletes can use situational probabilities (e.g., whether a pitcher favors a fastball for a particular count in baseball) to improve performance, however, there has been relatively little empirical work on this topic. This is an important limitation given that the so called 'Moneyball' approach now used in most sports has led to athletes being provided with complex statistics related to their opponents' tendencies which can be used to supplement any intrinsic contextual information they have acquired. Here I present a series of studies on baseball batting and pitching demonstrating: i) the use of general contextual rules, (ii) the use of intrinsic contextual information about a specific opponent (acquired through experience) to prepare movements for high probability events, (iii) a trade-off between short-term performance benefits and negative transfer when facing a new opponent which is dependent on how extrinsic information is presented, and (iv) extrinsic contextual information can induce ironic performance effects under pressure. Contextual information can be used to improve sports performance, however, care must be taken in how extrinsic information is presented to an athlete in order to avoid negative transfer and pressure-induced performance failures.

Exploring contextual information usage and anticipatory performance in elite tennis
Farrow, Damian, Victoria University and Australian Institute of Sport; Whiteside, David, Victoria University and Tennis Australia; Reid, Machar, Tennis Australia

Spatio-temporal relationships between performers are an established contextual information source used to guide anticipatory judgments. However, not all of this information is consciously perceived or utilized by performers. Previous research (Masters et al., 2007) has demonstrated that a penalty kick taker in soccer is sub-consciously attracted to kick to the side of the goal-face perceived to be larger (i.e., open side). This study explored an analogous situation in elite tennis analysing 106 male players who competed in singles at the 2012–2015 Australian Open tournaments. Synchronous three-dimensional ball and player position data were recorded during each point using the tournament's 10-camera adjudication system (Hawk-Eye Innovations). Of particular interest was whether the returner's position influenced the server's choice of first serve direction and whether the returner used this positioning to enhance their response. A total of 8708 serve-return situations were analysed. The angular space available in the service box on either side of the returner was computed to generate a service direction frequency measure and was explored relative to server and returner positioning. Binomial, chi-squared and one sample t-tests were used to determine whether player behavior differed significantly from chance levels. While the server directed more serves to the open side ($P = .003$), notably this occurred at significantly greater than chance levels when the returner was marginally off-center (less than 10 percent more space on one side of the service area). Given this angular variation (.35deg in the returner's lateral position) is arguably imperceptible, it is suggested that the server was unaware of this. In contrast, the returner's anticipatory movements (within 1s pre-server contact) demonstrated above chance levels of anticipatory movement toward the open side, irrespective of his location, and was more

suggestive of a deliberate strategy. Discussion will focus on the capacity to extend our understanding of such relationships in the expert performance setting.

The contextual dark side: The misuse of probabilistic information in the anticipation of action outcomes

Mann, David L., Schaefers, Teuntje Canal-Bruland, Rouwen, Vrije Universiteit Amsterdam

In time-constrained motor actions, one possible way of anticipating the actions performed by an opponent is to acquire information about their action preferences. However, there is reason to doubt that anticipatory responses would be unequivocally enhanced by situational information about the opponent's preferred action. It could be that explicit information about an opponent's preferences would distract skilled performers from using the kinematic information they would usually rely on for anticipatory responses, particularly if the opponent performs an unexpected action. The aim of this study was to examine how the ability to anticipate the outcome of an opponent's actions is influenced by exposure to the action preferences of that opponent. Two groups of skilled handball goalkeepers anticipated the direction of penalty throws performed by two opponents before and after a training phase where participants viewed videos that demonstrated situational probability information in the form of the action preferences (AP) of the opponents. During training participants in an AP-training group anticipated the action outcomes of two throwers who had a strong preference to throw in one particular direction, while participants in a NP-training group viewed players who had no bias in their throwing direction. Findings revealed that exposure to opponents who did have an action preference during training resulted in improved anticipatory performance when the opponent continued to bias their throws towards their preferred direction, but decreased normal performance if the opponent did not. Information about situational probabilities is not always used in a beneficial manner, as a mismatch between the expected and actual outcome of an opponent's actions significantly decreases performance when compared to judgments that are based on kinematic information alone. The findings highlight the need for a conceptual framework to help understand the way that expert performers combine kinematic and contextual information to support their superior skill in anticipation.

Opponents' action preferences affect action outcome anticipation in team-handball goalkeeping: A replication with novices

Loffing, Florian, Stern, Ricarda, Hagemann, Norbert, University of Kassel

Contextual information linked to domain-specific situations (e.g., on-court position; Loffing & Hagemann, 2014) seems more relevant to skilled than novice athletes' action outcome anticipation. Conversely, we expect that more salient contextual sources such as an opponents' action preferences (AP), recently found to affect skilled goalkeepers' anticipation in team-handball penalties (Mann et al., 2014), are used by novices as well. To test this, we replicated the experiment by Mann et al. with 32 handball goalkeeping novices (age: M = 24.78 years, SD = 2.92; 7 females). In three consecutive blocks (pre-test, training, post-test), participants watched videos of handball penalties occluded 40 ms before ball release and anticipated throw direction as fast and accurate as possible via key press. In the tests (48 trials each), one thrower had an AP towards the top-left corner (75% of all shots) while the other thrower had no AP (25% per corner). During training (72 trials different to tests), for half of the participants both throwers had an AP identical to that in the tests, while for the other half both throwers had no AP. Participants received feedback on throw outcome during training but not in tests. A 3-way mixed ANOVA on percentage of correct corner prediction in tests revealed a Group (with vs. without AP in training) x Time of Testing (pre- vs. post-test) x Action Preference in Test (with vs. without) interaction, $F(1, 30) = 32.41$, $p < .001$, "$p^2 = .52$. The group with AP in training improved from pre- to post-test against a thrower with AP ("M = 26.82%) but not against a thrower without AP ("M = 1.04%). Thus, knowledge of an opponents' AP facilitated anticipation if a thrower had the same AP in test and training. Conversely, the group without AP improved against a thrower without AP ("M = 10.16%), suggesting a short-term training effect, but not against a thrower with AP ("M = 1.82%). We propose that discussion of the role of contextual information sources for skilled anticipation may benefit from differentiating sources into skill-dependent vs. -independent.

Sport and Exercise Psychology

Where does HIIT fit now? Evaluation of the current psychosocial literature on interval exercise
Organizer: Stork, Matthew, McMaster University
Discussant: Costas I. Karageorghis, Brunel University

In recent years, interval exercise has received recognition as a potential time-efficient alternative to traditional endurance exercise. A large body of physiology research has shown that interval training can induce physical and health-related adaptations similar to those of moderate-intensity continuous exercise in symptomatic and asymptomatic populations. As a result of this evidence, there is strong consensus on the numerous physical benefits interval exercise incurs. However, our current understanding of the psychosocial benefits, outcomes, and implications of engaging in interval exercise remain in question. In this symposium, we will discuss the most recent findings on the psychological responses to interval exercise. Throughout this symposium, we will address some key factors associated with participating in this form of exercise (e.g., affect and intensity, cognitive adaptations, benefits and disadvantages, long-term adherence). The first presentation will focus on affective responses to acute interval exercise and will discuss some potential interventions that may be used to mitigate aversive responses. The second presentation will share the results from a study investigating the benefits of high-intensity interval training (HIIT) on memory function in younger adults. Specifically, the moderating effect of cortisol on the relationship between brain- derived neurotrophic factor (BDNF) and memory will be discussed as a potential mechanism. The third presentation will focus on adherence to interval exercise in sedentary, overweight, and prediabetic populations. This symposium will conclude with the discussant providing a summary of the talks and offering his perspective. Taken together, this symposium will stimulate conversation about the viability of interval exercise as an alternative to the more traditionally prescribed endurance exercise.

Acute interval exercise: A discussion of key underlying factors
Stork, Matthew J., McMaster University

In order to gain a deeper understanding of the psychosocial implications surrounding interval exercise, it is critical to investigate factors that influence one's experiences during acute interval exercise. Such factors will ultimately play an important role in determining whether an individual adheres to such exercise behaviour in the long term. The aim of this presentation will be to consider some of the underlying factors involved with participation in acute sessions of interval exercise. This talk will provide an overview of the current research on interval exercise and affect, emphasizing that interval exercise throws a "curveball" into the way we traditionally think about the relationship between affect and intensity. Further, comparisons of graphical representations of new acute exercise data from interval and endurance exercise protocols completed by sedentary participants will be presented. This talk will conclude by considering potential interventions and approaches that may be used to reduce the aversiveness of, and improve affective responses to, interval exercise. Such interventions to be discussed include the use of music and motivational priming.

High-intensity interval training improves memory in young adults
Heisz, Jen J., McMaster University

Physical exercise can improve memory function in humans yet the underlying mechanism is not well understood. It is hypothesized that exercise up-regulates brain-derived neurotrophic factor (BDNF) to improve hippocampal function, a key brain region involved in memory processing. However, this model was derived from animal research and the association between exercise, memory, and BDNF is not consistently observed in humans. Part of the complexity may be related to the stress response, as indexed by cortisol. High stress levels impair hippocampal function, and thus may negate the positive effects of exercise on memory. The present study examined the impact of high-intensity exercise training (HIIT) on hippocampal-activated memory, BDNF, and cortisol in young adults. Sixty-six sedentary participants were randomly assigned to a HIIT exercise group or a no exercise control group. The HIIT group exercised three times per week for six weeks. Following the intervention, the HIIT group increased in hippocampal-activated memory performance ($p < .05$) and decreased in serum BDNF ($p < .01$) relative to the control group. Critically, individual differences in the change in cortisol moderated the relationship between BDNF and memory ($p < .05$). Specifically, when cortisol decreased memory improved regardless of serum BDNF levels.

Whereas, when cortisol increased, memory improved only when serum BDNF levels decreased. This makes sense if the decrease in serum BDNF indicates an increase in BDNF uptake by the brain to support hippocampal function. The results suggest that exercise-induced improvements in memory may depend on BDNF but only under conditions of high stress. These findings are especially important because memory benefits were found from a relatively short exercise intervention in high functioning young adults.

Adherence to High-Intensity Interval Training: A critical examination of current evidence

Jung, Mary E., University of British Columbia

Low-volume, high-intensity interval training (HIIT) promotes similar health benefits as continuous moderate-intensity exercise in significantly less time (Gibala, 2007). A bout of HIIT consists of brief intervals of vigorous exercise interspersed with short rest periods. Mastery experiences, satisfaction with outcomes, decreased time commitment and monotony may make HIIT more attractive than continuous moderate-intensity exercise despite the greater intensity required during exercise. We have recently conducted a series of studies in individuals with prediabetes and type 2 diabetes to assess the overall tolerability and adherence to HIIT. We are consistently demonstrating that vigorous exercise, when performed in an interval fashion is successfully adhered to. Interestingly, regardless of in-task affective responses, when asked to choose which modality of exercise participants would prefer most, the majority of individuals choose HIIT over continuous moderate-intensity exercise. Based on our cumulative data on the tolerability of interval exercise, and associated adherence, promoting HIIT in healthy and chronic disease populations will be discussed.

Friday, June 17

Motor Development

Novel approaches and assessments influencing associations among perceived competence, motor competence and children's physical activity
Organizer: David F. Stodden, University of South Carolina
Discussant: Nancy Getchell, University of Delaware

Perceptions of physical competence and actual motor competence are critical factors in childhood development. As the development motor competence and one's perceptions of competence, inherently are related processes, it is important to understand how they impact children's behaviors and habits. Babic et al. (2014) demonstrated that, among various measures of self-concept, perceived competence is the strongest predictor of children's physical activity levels across childhood. Logan et al. (2015) and Holfelder and Schott (2014) indicated there also is strong evidence linking motor competence to children's physical activity. Finally, Barnett et al. (2008, 2011) and Stodden et al. (2008) have linked, via a mediating mechanism, that the synergistic influence of perceived competence and motor competence on children's physical activity is stronger than when isolated by individual components. However, when addressing the impact of these two variables on physical activity and other health-related variables across childhood, questions specifying antecedent/consequent causation and the relative impact of the development of each individual variable on physical activity and other health-related variables remain. Additional issues have arisen questioning the measurement of perceived competence, which is based on single pictures or verbal descriptions of motor skills that do not adequately capture the dynamic nature of coordinative movement or discriminate between competence levels. A more accurate and discriminating assessment of perceived motor competence will enhance its predictive validity and utility. The first three presentations will examine the link between perceived competence, actual motor competence and physical activity levels at different ages across childhood. The last two presentations will address limitations in perceived competence assessments that have been used previously and present data on new assessments. The discussant will provide commentary on the importance of this area of research and discuss opportunities and recommendations for future research.

Pre-schoolers physical activity predicts actual and perceived motor competence at school starting age
Barnett, Lisa M., Hesketh, Kylie, Deakin University

There is now convincing evidence that physical activity and motor skill competence are associated in children (Holfelder & Schott, 2014; Lubans, et al., 2010; Robinson, et al., 2015). In addition, high perceptions of physical competence contribute to physical activity (Babic, et al., 2014). Yet longitudinal evidence is lacking to inform the causal pathway. This study is the first to investigate preschool physical activity as a predictor of subsequent motor skill competence. Methods: Children were assessed as part of the Melbourne InFANT Program longitudinal cohort study. Children assessed at 3.5 (n = 118) and 5 years old (n = 127) were used for this analysis. Moderate-vigorous physical activity (MVPA) (accelerometry) was assessed at 3.5 years. At age 5, children were assessed in actual (Test of Gross Motor Development-2, TGMD-2) and perceived motor competence (Pictorial Scale of Perceived Movement Skill Competence). General linear models were performed with all 12 skills, object control (six skills) and locomotor (six skills), both actual and perceived, at age 5 as respective outcome variables. The predictor variable was MVPA at 3.5 years. Models were adjusted for original intervention/control classification, sex, age and valid monitor wear time days.Results: Based on standardized TGMD-2 scores, most 5 year old children were average or below. At 3.5 years MVPA was associated with actual locomotor skill (B = 0.073, p = 0.033) and perceived total skill at 5 years of age (B = 0.059, p = 0.044); i.e. 15 more MVPA minutes p/day at 3.5 years old equals around one more point in perceived competence, similar to shifting from 'sort of good" to "pretty good" in

one skill. MVPA was not a predictor of actual or perceived object control skill. Discussion: It is probable that object control skills need specific targeted learning opportunities rather than simply time in MVPA. Parents and preschool staff should be informed that more time in MVPA as a preschool child contributes to locomotor skill and to perceptions of skill ability in a child of school starting age.

Performance outcomes associated with a year-long mastery motivational climate physical education program for preschoolers

Rudisill, Mary E., Wadsworth, Danielle D., Hernandez, Mynor R., Irwin, Jacqueline M.; Auburn University

Although early childhood educators may implement one of many types of learning environments to help children develop fundamental motor skills and participate in physical activity, children typically engage in unplanned free play at preschool or daycare. While free play may allow children to practice fundamental motor skills and participate in physical activity, it lacks important feedback and encouragement from teachers that helps young children develop an intrinsic motivation towards physical activity and master movement. Researchers report that the type of motivational climate implemented in a learning environment influences one's motivation to engage in achievement behaviors such as physical activity and motor skill learning and will affect feelings of perceived competence. Mastery motivational climates are characterized as children driving their own learning and engagement in movement, while the teacher serves as a facilitator within the environment in which effort and personal improvement define success. Studies have found that mastery motivational climates are an effective approach to increase physical activity participation in early childhood settings, as well as develop motor skills, which to increases in perceived competence. However, these interventions were short in duration. We conducted a 20-week (1800 minutes) mastery motivational climate intervention for preschool children. Physical activity was objectively assessed with accelerometers during each play session. Fundamental motor skills and perceived competence were assessed three times over the course of the intervention. We will discuss changes in physical activity, sedentary behavior, motor skills, and perceived competence over the course of the intervention as well as the relationship between these variables. Findings will be discussed as they relate to Stodden and colleagues (2008) proposed a model of predicting children's physical activity engagement. We will also examine lessons learned, and barriers and facilitators in effectively delivering long-term play interventions to this population.

Associations among motor competence, perceived motor competence and physical activity in children

De Meester, An, Ghent University; Stodden, David F., University of South Carolina; Goodway, Jackie D., Ohio State University; Brian, Ali, University of South Carolina; True, Larissa K., SUNY Cortland; Tallir, Isabel, Cardon, Greet, Haerens, Leen, Ghent University

Objectives: Positive associations between motor competence and physical activity (PA) have been identified in previous studies by means of variable- centered analyses. To expand the understanding of these associations, this study used a person-centered approach to 1) investigate if different combinations (i.e., profiles) of actual and perceived motor competence (AMC, PMC) exist (e.g., some children score high on one construct and low on the other, while others score high or low on both constructs); and 2) examine differences in PA-levels among children with different MC/PMC profiles. Methods: Participants included 360 children (50% boys; age=9.50"1.24y). The Self-Perception Profile for Children (Harter, 2012) was used to assess children's PMC while 5- day PA levels (MVPA min/day) were assessed via Actigraph accelerometers. Children's MC was assessed using the Test of Gross Motor Development 2 (Ulrich, 2000). Cluster analyses (aim1) and an ANCOVA (aim2) were used to analyze the data. Results: The analysis generated two predictable groups: one group displaying relatively high levels of MC (M of TGMD = 42nd percentile) and PMC (M=3.42), and one group with relatively low levels of both (M = 9th percentile, M PMC=2.51). One additional group was also identified (relatively low levels of MC (M = 4th percentile), but relatively high levels of PMC (M=3.52). After controlling for age and BMI, children in the relatively high MC and PMC group demonstrated higher daily MVPA (M=48 +-2min/day p<.01) than children with both low MC and PMC (M=38 +- 2min/day) and children with low MC and overestimated PMC (M=37 +-2min/day). Conclusion: Promoting both high MC and high PMC would seem to be advantageous for promoting higher daily PA levels in children. As the average MC for the "high MC" group was rather modest in terms of TGMD 2 normative data (42nd percentile), promoting higher MC and PMC may produce even higher daily PA-levels. As MC and PMC

change across childhood, further research is needed to understand how associations among these variables may change over time.

Reliability and internal consistency of a digital-based instrument to examine perceived motor competence in preschool aged children

Palmer, Kara K., University of Michigan; Brian, Ali, University of South Carolina; Robinson, Leah E., University of Michigan

An individual's perceived motor competence (PMC; perceptions toward their movement ability) supports his/her physical activity engagement and helps establish positive developmental trajectories. Several scales (e.g. Pictorial Scale of Perceived Competence and Acceptance for Young Children; Pictorial Scale of Perceived Movement Skill Competence) have been developed to assess PMC in young children. However, these scales lack alignment with current measurements of motor skill competence and/or use static pictures that do not fully represent coordinated movement. This study determined the reliability and internal consistency of a digital-based instrument aligned with the Test of Gross Motor Development-2nd Edition to assess PMC in young children. One hundred preschool-age children from two geographic regions served as participants in the study. The sample consisted of 50 children from the Midwest (Mage= 4.9".89; 25 girls) and 50 children from the South (Mage= 4.3 yrs".42; 28 girls). The instrument design and layout was similar to the Pictorial Scale of Perceived Movement Skill Competence (Barnett et al., 2014). Children completed the test on two separate occasions with 7-10 days between each assessments. Intra-class correlations (ICC) and Cronbach's alpha determined test-retest reliability and internal consistency. The assessment demonstrates excellent test-retest reliability (ICC=.815) and for each subscale, locomotors (ICC=.769) and object control (ICC=.781). The assessment also displays excellent/acceptable levels of internal consistency for the total assessment (α= .822) and each subscale, locomotor (α= .710) and object control (α=.740). Findings support that this digital-based instrument is a valid tool and may be used to measure PMC in preschool aged children in additional to school-age populations (Robinson et al. 2015, Robinson & Palmer, in review).

Perceptions of competence and motivation: Measurement concerns and solutions

Rudisill, Mary E., Wadsworth, Danielle D., Auburn University; Irwin, Jacqueline M., Auburn University

Perceptions of competence have been viewed as a critical factor associated with achievement motivation theory for more than 50 years. Theorists and supporting research suggest that goal orientations are linked to perceptions of competence, intrinsic motivation, and effort; and that perceptions of competence and intrinsic motivation facilitate the relationship between goal orientations and effort (Williams & Gill, 1995). In recent years, Stodden and colleagues (2008) proposed a model that suggests that perceived competence is a developmental mechanism in predicting children's physical activity engagement. Researchers interested in better understanding what motivates young children to learn to move and be physically active have been measuring perceptions of competence using Harter and Pike's pictorial scale since 1984. Researchers have reported that the scale is limited in a number of ways when measuring perceptions of young children. In this introductory presentation, the importance of accurately measuring perceptions of competence will be discussed. New data related to the limitations of Harter and Pike's scale and concerns researchers should have when measuring this construct will be presented. We will also discuss information related to a new scale designed to eliminate restrictions associated with accurately measuring perceptions of competence will also be presented.

Sport and Exercise Psychology

Addressing population level mental health through organized sports
Organizer: Stewart Vella, University of Wollongong

A national and sustainable sports-based intervention to improve mental health and wellbeing among adolescent males
Vella, Stewart A., Swann, Christian, University of Wollongong; Telenta, Jo, Jones, Sandra, Australian Catholic University; Liddle, Sarah, Hurley, Diarmuid, Deane, Frank, University of Wollongong; Boydell, Katherine, Fogarty, Andrea, University of New South Wales; Okely, Anthony, University of Wollongong

Young men and boys represent the group at highest risk of mental health problems and suicide in one third of developed countries, including Australia. The onset of half of all psychological disorders occurs before the age of 14 years, and childhood psychological disorders are recognised as one of the most prominent contributors to the global burden of disease among young people. This symposium presents a coordinated and comprehensive program of presentations that report on a national and sustainable intervention to promote mental health and reduce the risk of mental health problems among adolescent males. The research project – funded by the Movember Foundation - aims to sustainably transform Australian community sports into a vehicle for the promotion of male mental health. The project aims to do this by formulating, testing, and then embedding an innovative, multi-level, multi-component intervention into the ongoing practice of our research partners, including the Australian Sports Commission, and the governing bodies of six of Australia's most popular sports (soccer, Australian Rules football, cricket, swimming, tennis, and basketball). The presentations within this symposium report on the theory, research, and outcomes associated with the design, implementation, and translation of this national sports-based mental health project. Specifically, we: (i) outline the overall aims and methods of the research program; and then provide more specific details about the design and implementation of interventions we have developed for (ii) adolescent male athletes; (iii) coaches; and (iv) parents. We hope that viewers will take away insights into the use of organised sports to combat rising numbers of mental health problems at a population level, and insights into the design and implementation of sport-based mental health programs for adolescents, coaches, and parents. Lastly, we hope that the symposium will commence a dialogue regarding the role of sports in facilitation of population mental health and the mechanisms through which this may be achieved.

A multi-component intervention to increase psychological wellbeing, mental health literacy, and help-seeking intentions among adolescent male athletes
Vella, Stewart A., Swann, Christian, University of Wollongong; Telenta, Jo, Jones, Sandra, Australian Catholic University; Liddle, Sarah, Deane, Frank, University of Wollongong

This presentation discusses the design, implementation, and preliminary analysis of a multi-component mental health and wellbeing intervention for adolescent males which contributes to a multi-faceted national sports-based mental health project. Broadly, the project sought to promote mental health and reduce the risk of mental health problems among adolescent males (aged 12-17) across six of Australia's most popular sports (soccer, Australian Rules football, cricket, swimming, tennis, basketball). The aims of this particular intervention were to: (i) increase mental health literacy regarding the most common mental health problems among adolescent males; (ii) increase help-seeking intentions and willingness to provide mental health first aid to others; and, (iii) improve psychological wellbeing. The multi-component intervention is comprised of three major initiatives including: a prominent messaging campaign in sporting clubs based on social marketing theory; a brief mental health literacy and mental health first aid program called 'Help Out a Mate' which is presented to adolescent males at their sports club; and, a 6-week online sport psychology course that aims to improve both performance and psychological wellbeing through psychological skills training. This presentation discusses preliminary data from phase one of implementation which aimed to target over 50 sports clubs from Australian Rules football, soccer, and basketball. The results are compared against a standard mental health literacy program implemented across the same sports in a different geographic location. Specifically, these data evaluate the effects of the intervention on: (i) mental health; (ii) wellbeing; (iii) mental health literacy; (iv) help-seeking intentions and intentions to provide help to others; and, (v) perceived social support.

An internet-supported coach training program for creating a needs-supportive motivational climate among adolescent male athletes

Vella, Stewart A., University of Wollongong; Lonsdale, Chris, Australian Catholic University; Liddle, Sarah, Swann, Christian, University of Wollongong; Keegan, Richard, University of Canberra

This presentation discusses the design, implementation, and preliminary analysis of an intervention for coaches which contributes to a multi-faceted national sports-based mental health project. Broadly, the project sought to promote mental health and reduce the risk of mental health problems among adolescent males (aged 12-17) across six of Australia's most popular sports (soccer, Australian Rules football, cricket, swimming, tennis, basketball). The aims of this particular intervention were to: (i) teach coaches how to create a needs supportive motivational climate in their work with adolescent male athletes; (ii) help coaches learn strategies that support their players' needs to feel competent, autonomous and closely connected to others (i.e., relatedness); and, (iii) teach coaches how to help their players transfer skills learned in the sporting context (e.g., independent thinking, cooperation) into other areas of their life. The 14-week training program employed a blended approach of face-to-face delivery (i.e., two workshops), six online modules, and two mentor meetings (either online or face-to-face) – all of which were delivered by sport psychology consultants. This presentation discusses preliminary data from phase one of implementation which aimed to target over 50 sports clubs from Australian Rules football, soccer, and basketball. The results are compared against a mental health literacy program implemented across the same sports in a different geographic location. Specifically, these data evaluate the effects of the intervention on: (i) players' mental health and wellbeing; (ii) players' perceptions of supportive and controlling behaviour by coaches; (iii) autonomous and controlled motivation in players; and (iv) athlete engagement and burnout.

A mental health literacy program for parents to promote mental health and wellbeing among adolescent male athletes

Hurley, Diarmuid, Vella, Stewart, Allen, Mark, Okely, Anthony, Swann, Christian, University of Wollongong

This presentation discusses the design, implementation, and preliminary analysis of a mental health literacy intervention for parents of adolescent male athletes. This intervention is one component of a multi-faceted national sports-based mental health project. Broadly, the project sought to promote mental health and reduce the risk of mental health problems among adolescent males (aged 12-17) across six of Australia's most popular sports (soccer, Australian Rules football, cricket, swimming, tennis, basketball). The aims of this particular intervention were to: (i) promote mental health awareness and mental health literacy among parents, ii) give parents the confidence and knowledge to support their child's as well as their own mental health by seeking help if necessary; and, (iii) encourage positive, open communication between parents and adolescents. The program utilised a blended approach of visual print material placed strategically in sporting clubs throughout the sporting season as well as supplementary material delivered electronically via online and app platforms. This presentation discusses preliminary data from phase one of implementation which aimed to target over 50 sports clubs from Australian Rules football, soccer, and basketball. The results are compared against a generic mental health literacy program implemented across the same sports in a different geographic location. Specifically, these data evaluate the effects of the intervention on: (i) parents' knowledge of mental health and help seeking; (ii) parents' attitudes towards mental health and help seeking; and (iii) adolescents' perceptions of positive social support from parents.

Saturday, June 18

Motor Development

Global perspectives on promoting motor competence and physical activity in the early years: Implications to practice and policy
Organizer: Jacqueline Goodway, The Ohio State University
Discussant: Jacqueline Goodway, The Ohio State University

The Active Start guidelines for preschoolers recommend the development of fundamental motor skills and 60 minutes of structured physical activity (PA) per day (NASPE, 2009). Yet many preschoolers are not close to meeting these guidelines (Cardon et al., 2009). Evidence supports the importance of motor competence (MC) as an underlying mechanism driving PA behaviors across childhood (Robinson et al., 2015) and the need to promote a positive developmental trajectory in the early years (3-7 years). This symposium will take a global perspective on promoting MC and PA in young children. The first presentation explains Complexity Thinking as a new paradigm in instructing young children and provides lessons learned from the Early/Basic Moves framework implemented across Scotland. The 2nd presentation undertakes a cross cultural comparison of the MC and perceived motor competence (PMC) of Belgian and US children revealing the significance of early year's instruction by a physical education (PE) specialist. The 3rd presentation asks the question, when given a chance to be active during recess, how active are preschoolers? It highlights that children with more MC had greater MVPA. The 4th paper looks to Indonesia, a developing country that has recently joined the ranks of the 10 most obese nations in the world. It identifies early governmental efforts to develop evidenced-based policy and practice. This paper is the first study in Indonesia investigating the MC and PA levels of both urban and rural children. The final presentation turns to an examination of the Welsh Foundation Phase early year's national curriculum where all academic disciplines like math and PE are integrated into a playful pedagogy using the outdoors. This paper shows how locomotor skills emerge through such an approach but object control skills need more explicit instruction. This symposium will conclude with a reaction to these papers highlighting evidenced-based best practice, challenges and recommendations for early childhood policy, and areas for future research.

Complexity thinking and early childhood movement and physical activity
Jess, Mike, University of Edinburgh

This paper presents a complexity-informed framework focused on young children's developing movement competence and physical activity engagement. Connecting with principles from social constructivism and situated learning, the framework views young children as complex systems actively engaged in a learning process that is self-organizing, iterative, increasingly collaborative and non-linear. As such, the paper explores how principles from complexity thinking, namely self- organization, ambiguous boundaries, edge of chaos, connectedness, nestedness, recursive elaboration, similarity and diversity, support learning experiences that support the development of a robust physical education foundation. By creating conditions for the design of flexible learning tasks that accommodate predictable and potentially unpredictable outcomes, the framework represents a move away from more traditional positivist approaches that have long been reported to dominate practice. Central to the framework's application has been an ongoing engagement with the core learning that focuses on the fundamental movement and physical activity learning that facilitates application and transfer across different physical activity contexts. Based on experiences

focused on similarities and diversities, core learning refers to those tasks that recognize the complex interaction of children's physical, cognitive and affective learning and helps develop the efficiency, adaptability and creativity needed to participate in different physical activity contexts. These ideas will be illustrated by drawing on the Early Moves and Basic Moves program developed and implemented in Scotland. In conclusion, this paper challenges prior instructional practice and highlights how, as a complex phenomenon, this vision of core learning is not perceived as a set of pre-programmed "building blocks" but embodies experiences that seek to scaffold the non-linear nature of children's movement and physical activity learning over time.

Cross-cultural comparison of fundamental motor skills in children from Belgium and the United States

Brian, Ali S., University of South Carolina; Bardid, Farid, Ghent University; Barnett, Lisa, Deakin University; Deconinck, Frederik, Lenoir, Matthieu, Ghent University; Goodway, Jacqueline D., The Ohio State University

Fundamental motor skills (FMS) play a crucial role in the physical activity (PA) levels of children. Yet, many children across the globe demonstrate below average skill levels. Cross-cultural research on FMS is limited due to the adoption of different motor assessments. The aim of this study was to investigate the actual FMS as well as the association between FMS and skill perceptions of children from Belgium and the United States (US). The study sample consisted of 197 (57.4% boys) Belgian and 171 (44.4% boys) US children, aged 3 to 5 years. Children's FMS were assessed with the Test of Gross Motor Development-2 and their skill perceptions (PMC) were assessed with the Pictorial Scale of Perceived Movement Skill Competence for Young Children. Multilevel regression analyses were conducted to examine country differences and the role of skill perceptions in children's FMS. Results show that Belgian children scored significantly higher on both locomotor skills (beta=10.45; SE=1.86; p<.001) and object control skills (beta=4.55; SE=1.34; p=.01) than US children. Children's object skill perceptions were positively related to their actual object control skills (beta=0.36; SE=0.09; p<.001); there was no significant relationship between children's actual and perceived locomotor skills (beta=0.13; SE=0.12; p>.05). Country status did not influence these relationships. The cross-cultural difference in FMS between Belgian and US children may be accounted for by the fact that Belgian children receive physical education (PE) from a specialist starting at 3 years of age and US children only receive well-equipped free play. The lack of country differences in the relationship between actual and perceived FMS may be because PMC is just emerging at this age and country differences in self-perception may not occur until children are older. Future research may consider exploring cultural differences in PA contexts such as PE and access to playgrounds and organized sports to provide appropriate recommendations for practitioners and policy makers.

Who is sitting on the playground? Examining the underlying mechanisms associated with being physically active during free play on the playground in preschoolers

Tsuda, Emi, Goodway, Jacqueline D., Famelia, Ruri, The Ohio State University; Brian, Ali S., University of South Carolina

The Active Start Guidelines for children birth to age 5 suggest a daily minimum of 60 minutes of structured and unstructured physical activity (PA) (NASPE, 2009). However, recent studies have revealed that many children are failing to meet these recommendations (Cardon et al., 2009; Tucker, 2008). The primary purpose of this study was to investigate the extent to which children engaged in moderate to vigorous physical activity (MVPA) on the playground during recess and the influence of actual and perceived motor competence (PMC) as potential underlying mechanisms driving PA behaviors. A total of 72 children (M age = 4.38, SD = .85) were recruited from the two preschools. Four sources of data were collected, PA levels, motor competence (MC), PMC, and BMI. An accelerometer assessed MVPA and sedentary levels averaged across 3 days of recess. The Test of Gross Motor Development-2 (Ulrich, 2000) evaluated MC. The Physical Competence subscale (Harter & Pike, 1984) assessed PMC. On average children engaged in MVPA for 36.41% (14.66 min, SD = 6.48) and sedentary behavior for 43.94% (18.11 min, SD = 6.02) of the recess time. A stepwise multiple regression was conducted to examine the potential predictors of MVPA. Locomotor competence (p<.001), gender (p=.002), BMI (p=.017), and PMC (p=.039) significantly predicted 43.7% of the variance in MVPA during recess (F [4, 67]=12.998, p<.001). This study reveals children were in MVPA for only a third of recess time suggesting we need to find ways to encourage preschoolers to be more active on the playground. The findings from the regression analysis highlight the importance of developing MC during early childhood as locomotor competence was one of the highest predictors of MVPA. Overall, if recess is where children are supposed to meet the 60 minutes of structured and unstructured PA, it is clear from these

findings that these children are a long way from meeting these guidelines and playground intervention is warranted. These data have implications for practice and policy.

Investigating the motor competence and physical activity of Indonesian, Muslim preschoolers from urban and rural areas

Famelia, Ruri, Goodway, Jacqueline D., The Ohio State University; Bakhtiar, Syahrial, Mardela, Romi, State University of Padang

Indonesia has recently been become one of the top ten most obese countries and as such the government has called for evidenced-based policy development. As a developing country, there has been a large migration from rural to urban areas with research suggesting urban children have increased screen time with concerns about sedentary behaviors. Governmental directives have suggested the need to address these issues starting in the early childhood years. A growing body of evidence has reported the importance of motor competence (MC) as an underlying mechanism for physical activity (PA) behaviors of children. However, no PA or MC data exists on young, Indonesian children to inform the development of programs and policy. Thus, this pilot study examined location (urban, rural) and gender differences in MC and PA levels of Indonesian preschoolers. Participants were 35 urban (14 boys) and 31 rural preschoolers (16 boys), aged 4-to-5 years. MC was evaluated by the Test of Gross Motor Development-3 and PA by the ActiGraph wGT3X-BT accelerometer worn across three school days. Four, 2 Gender X 2 Location ANOVAs were conducted on locomotor (LOC) and object control (OC) sub scale raw scores, and on percentage of the school day spent in sedentary behavior (SED) and moderate to vigorous PA (MVPA). There were no main effects/interactions ($p>.05$) for LOC skills (boys M=17.87, girls M= 18.72 out of 46). There was a significant gender effect ($F[1,62]=6.82$, $p= .011$) for OC skills favoring boys (boys M=18.93, girls M= 16.39 out of 54) but no significant difference for location and the interaction ($p>.05$). Both percent of the school day spent in MVPA and sedentary behaviors revealed non-significant main effects and interactions ($p>.05$). However, preschoolers spent 79% of their school day in sedentary behavior, and only 7% of the day in MVPA. These findings have implications to policy development in Indonesian schools and suggest a need to re-structure the day to provide more opportunities to be PA at school and develop MC.

Examining the impact of the foundation phase on young children's motor development

Wainwright, Nalda, University of Wales, Trinity St David; Goodway, Jacqueline, The Ohio State University; Whitehead, Margaret, University of Bedfordshire; Williams, Andy, University of Wales Trinity St David; Kirk, David, University of Strathclyde

The Welsh Foundation Phase (FP) is a play-based curriculum emphasizing outdoor learning for young children. As a holistic approach to learning, traditional subjects including Physical Education no longer exist. The FP does retain teacher led physical development lessons alongside an increase in child initiated learning raising important questions in relation to the impact of the FP on pupils' fundamental motor skill (FMS) development and Physical Literacy. This mixed methods (quantitative/qualitative) study examined the impact of the FP on FMS development as part of a broader context of Physical Literacy, exploring the question: What is the impact of the FP on young pupils' FMS development in the absence of Physical Education (PE)" Participants (N=49) were in 2 classes of pupils aged 5-6 years. Quantitative data generated on a subset of pupils used the Test of Gross Motor Development-2 three times across one year. Qualitative data was generated through weekly episodes of participant-observation, field notes and video over one year with 228 pages of field notes and 66 films recorded. An ANOVA with repeated measures on the Gross Motor Quotient (GMQ) showed pupils in the FP significantly improved ($p<.001$) their FMS over the year. Further analyses revealed significant improvements in locomotor skills ($p<.001$) whilst object control (OC) skills did not improve ($p=.069$). Analysis of field notes and video data indicated children were highly active in all areas of learning in the FP and these high levels of play-based activity contributed to locomotor skill development. Overall the FP has a significant impact on pupils' locomotor skills but not OC skills. Qualitative data suggest pupils engaged in a variety of locomotor skills as part of their holistic learning using the outdoors across the FP. However the nature of these activities was not sufficient to impact OC skills. These data have practical and policy implications. Either specialist PE teachers are required or classroom teachers must receive professional development to promote OC development.

Perfectionism in sport, dance, and physical education: Helping or hindering performance, learning, and well-being?

Organizer: Daniel J. Madigan, University of Kent
Discussant: Patrick Gaudreau, University of Ottawa

Perfectionism has been shown to be a key predictor of various outcomes in sport and dance, and may be particularly significant for athletes' and dancers' well-being and performance (e.g., Gotwals, Stoeber, Dunn, & Stoll, 2012). Individual differences in perfectionism may also be associated with learning in achievement settings. By adopting a range of theoretical and methodological approaches, this symposium aims to offer further insight into the implications of perfectionism for athletes, dancers, and students. The first presentation uses semi-structured interviews to investigate the perfectionism-performance relationship in dancers. This is one of the few qualitative studies in this area and will offer unique insight into the experiences of perfectionist dancers. The second presentation presents research that applies a person-centered approach to investigate group differences in perfectionism in varsity athletes. Additionally, it explores the role that coping plays in mediating the perfectionism-burnout relationship. The third presentation provides a longitudinal counterpart to this study and discusses a three-wave study examining the extent to which motivation mediates the perfectionism-burnout relationship in junior athletes. It is only the third longitudinal study in this area and demonstrates the persistent impact of perfectionism over time. The fourth presentation turns our attention to the 2 x 2 model of perfectionism, and shows the influence of different subtypes of perfectionism on performance and well-being in soccer players. The final presentation compliments this study by adopting the 2 x 2 model and presenting a study that determines if the subtypes of perfectionism are differentially associated with learning a novel motor task in physical education. Overall, the research described here highlights the importance of perfectionism in sport, dance, and physical education.

On performance, pressure, and pointlessness: Elite dance students' and teachers' perceptions of perfectionism

Nordin-Bates, Sanna M., The Swedish School of Sport and Health Sciences

The notion of whether perfectionism is conducive to performance is hotly debated. However, studies in the area are few in number and have primarily been conducted using quantitative methods. For this presentation, the aim is to extend this line of research using qualitative interviews. As such, perceptions of perfectionism in dance, as expressed by both students and teachers from an elite school, were gathered via in-depth semi-structured interviews. To date, interviews have been collected with 8 full-time dance students, aged 12-19, and 7 teachers at the Swedish Royal Ballet School. Students take classes in both classical ballet and modern dance, and teachers represented both genres. Content analyses of interview transcripts revealed that the perfectionism-performance relationship is complex, and not necessarily linear. First, it was noted that interviewees agreed that perfectionistic concerns may be harmful (i.e., negatively related) to performance, and many other outcomes besides. Second, some responses indicated that perfectionistic strivings can lead to improved performance. However, respondents were clear that this relationship could only be considered positive and linear up to a point, beyond which perfectionistic strivings can instead impair performance. Specifically, it was described that if strivings are obsessive, rigid, or otherwise extreme, they will become detrimental. For instance, they can lead to overtraining, injury, or a lack of creativity. Some additionally outlined how striving for perfection is unrealistic, superficial rather than authentic in nature, and essentially pointless. In summary, the present study contributes real-life accounts of perfectionism, including perceptions of its consequences for performance, from high-level dance. It suggests that analyzing quantitative data under assumptions of linearity may not be able to reveal the complexity of the perfectionistic strivings-performance relationship, which could be in the shape of an inverted U.

Perfectionism, coping, and burnout among varsity athletes: A person-centered approach to investigating group differences and mediation

Pacewicz, Christine E., Michigan State University; Gotwals, John K., Lakehead University; Blanton, Jedediah E., University of Tennessee

Past studies have utilized cluster analysis to examine if groups of athletes defined by different perfectionism profiles differ in coping or burnout (Dunn, Causgrove Dunn, Gamache, & Holt, 2014; Gotwals, 2011). However, cluster analysis is sample-specific and overly subjective (Pastor, Barron, Miller, & Davis, 2007). It is also unclear whether coping is a mechanism that explains perfectionism group differences in burnout. To address these concerns, the present study (a) used latent profile analysis (LPA) to group athletes by their perfectionism profile, (b) investigated group differences across coping and burnout, and (c) examined whether coping mediated differences in burnout. A sample of 168 intercollegiate varsity student-athletes (M age = 19.85 years, SD = 1.45) completed the Sport Multidimensional Perfectionism Scale-2 (Sport-MPS-2; Gotwals & Dunn, 2009), the Coping Function Questionnaire (Kowalski & Crocker, 2001) and the Athlete Burnout Questionnaire (Raedeke & Smith, 2001). Models of 1-6 classes were developed through LPA using Sport-MPS-2 subscale scores as indicators. A 3-class model with groups reflecting nonperfectionism, healthy perfectionism and unhealthy perfectionism (cf., Stoeber & Otto, 2006) was chosen as the optimal solution. Inter-group comparisons indicated that the unhealthy perfectionists reported the highest levels of burnout as well as lower levels of emotion-focused coping and higher levels of avoidance-focused coping compared to the healthy perfectionists (all ps < .05). Mediation analyses indicated that the healthy and unhealthy perfectionists' differences on reduced accomplishment was mediated by the latter group's greater use of avoidance coping. Discussion focuses on (a) comparison of the present 3-class model and the resulting group differences in coping and burnout with results produced in past cluster analytic and LPA-based research (e.g., Dunn et al., 2014; Gustafsson, Hill, Stenling, & Wagnsson, 2015) and (b) interpretation of the findings in light of the (mal)adaptive nature of perfectionism in sport.

Motivation mediates the perfectionism-burnout relationship: A three-wave longitudinal study with junior athletes

Madigan, Daniel J., Stoeber, Joachim, Passfield, Louis, University of Kent

Perfectionism in sports has been shown to predict longitudinal changes in athlete burnout (Madigan et al., 2015). Perfectionism is a multidimensional personality characteristic and two higher-order dimensions have been differentiated: perfectionistic strivings and perfectionistic concerns. Whereas perfectionistic concerns predict increases in athlete burnout, perfectionistic strivings predict decreases. What mediates these relationships over time, however, is still unclear. Adopting a self-determination theory perspective and using a three-wave longitudinal design, the present study examined perfectionistic strivings (striving for perfection, personal standards), perfectionistic concerns (concerns over mistakes, negative reactions to imperfection), autonomous motivation, controlled motivation, and athlete burnout in 141 junior athletes (mean age 17.3 years) over 6 months of active training. Athletes completed the Sport Multidimensional Perfectionism Scale (Dunn et al., 2006), Multidimensional Inventory of Perfectionism in Sport (Stoeber et al., 2007), Behavioral Regulation in Sport Questionnaire (Lonsdale et al., 2008), and Athlete Burnout Questionnaire (Raedeke & Smith, 2001). When multilevel structural equation modeling was employed to test a mediational model, a differential pattern of between- and within-person effects emerged. Whereas autonomous motivation meditated the negative effect that perfectionistic strivings had on burnout at the between- and within-person level, controlled motivation mediated the positive effect that perfectionistic concerns had on burnout at the between-person level only. The findings suggest that differences in autonomous and controlled motivation may explain why perfectionism predicts changes in athlete burnout over time. With this, the present study provides further evidence for the important role that perfectionism and motivation play in explaining why some athletes may burn out while others continue to burn brightly.

Perfectionism and adjustment of soccer players: A test of the 2 x 2 model of perfectionism

Verner-Filion, Jeremie, Vallerand, Robert J., University of Quebec

The 2 x 2 model of perfectionism proposes that the two dimensions of perfectionism, namely self-oriented (SOP) and socially prescribed (SPP) perfectionism, can coexist within individuals to varying degrees (Gaudreau & Thompson, 2010; Gaudreau, 2012). Thus, the model proposes the existence of four distinct subtypes of perfectionism (pure SOP, pure SPP, mixed perfectionism, and nonperfectionism) that provide a useful way to examine the relation with outcomes in achievement settings, such as sports (Crocker, Gaudreau, Mosewich, & Kljajic, 2014; Gaudreau & Verner-Filion, 2012). This model also contains four hypotheses regarding the effects of each subtype of perfectionism on psychological adjustment and achievement. In fact, the model states that pure SOP can be associated to either better (H1a), worse (H1b), or equal (H1c) outcomes compared to nonperfectionism, thus providing support for the potentially healthy, unhealthy, and neutral nature of SOP. The model further proposes that pure SPP should be more damaging than nonperfectionism (H2) and mixed perfectionism (H3). In turn, mixed perfectionism should be associated with worst adjustment compared to pure SOP (H4). The goal of this study was to examine whether the four subtypes of perfectionism proposed by the 2 x 2 model are distinctively associated with indicators of athletic adjustment (i.e., need satisfaction, positive affect, anxiety, and performance) in a sample of soccer players (n = 226). The results of moderated hierarchical regressions for anxiety and performance provided support for all four hypotheses of the 2 x 2 model. However, partial support was obtained for need satisfaction and positive affect (H2 and H3, but not H1 and H4). Overall, the results demonstrate the viability of the 2 x 2 model of perfectionism for a better understanding of the combined effects of both dimensions of perfectionism on important outcomes in the sports domain.

Perfectionism and learning in physical education: Growth curve modeling of the 2 x 2 model of perfectionism

Gaudreau, Patrick, University of Ottawa; Louvet, Benoiy, University de Rouen

The 2 x 2 model of perfectionism (Gaudreau & Thompson, 2010) conceptualizes perfectionism as the within-person combinations of self-oriented (SOP) and socially prescribed (SPP) perfectionism to define four subtypes of perfectionism: non-perfectionism, pure SOP, mixed perfectionism, and pure SPP. This model posits that subtypes should be distinctively associated with psychological adjustment and achievement in domains such as sport and education. In this study, we examined whether subtypes of perfectionism are distinctively associated with learning when students are exposed to a new motor task in physical education. A sample of 97 middle school students (54% male) from 10 to 13 years of age (M = 11.82) participated in this study. They were enrolled in grade 9 and 10 mandatory physical education in a public middle school in France. Students participated in six consecutive physical education classes during which they had to learn and perform novel Acrosport figures. Performance was rated by the teacher at the end of each class. Results of multilevel growth modeling revealed that the performance of students decreased from the first to the third course before improving from the third to the sixth course (intercept = 71.90; linear slope = -6.08, $p < .01$, quadratic slope = 1.48, $p < .01$). Both the linear and quadratic slopes were significantly predicted by self-oriented perfectionism and socially prescribed perfectionism. Results of simple slopes showed that the decrease during the first three classes was significantly more pronounced for a subtype of pure SPP (linear slope = -16.31, $p < .01$) compared to mixed perfectionism (linear slope = -6.18, $p <.01$), pure SOP (linear slope = 2.52, $p < .05$), and non-perfectionism (linear slope = -6.85, $p <.01$). These findings, which supported the hypotheses of the 2 x 2 model of perfectionism, indicate that different subtypes of perfectionism are differentially associated to performance outcomes when students have to learn a new motor task in physical education.

HIIT Me Baby One More Time: The efficacy of dissociative techniques during high-intensity exercise
Organizer: Costas I. Karageorghis, Brunel University
Discussant: Jung, Mary E., University of British Columbia

The Diabetes Project: Effects of music and music-video during exercise in a clinical setting
Karageorghis, Costas I., Brunel University London; Pottratz, Suzanne T., Springfield College; Black, Jessica D., Mercy Medical Center

There is emerging evidence that combined auditory and visual stimuli can significantly enhance the exercise experience (Hutchinson, Karageorghis & Jones, 2014), albeit that this effect has yet to be examined in a clinical exercise population. We investigated the effects of music and music-and-video on physiological (blood glucose, heart rate), psychological (attentional focus, affective valence, enjoyment) and psychophysical (RPE) variables during exercise in a clinical outpatient setting. Twenty-four females (Mage = 66.0 years, SD = 8.5 years) enrolled in a supervised exercise program for people with diabetes participated in mixed-modality exercise sessions that included a standardized combination of flexibility, low-to-moderate intensity aerobic, and moderate-to-high intensity resistance-type activities under conditions of music, music-video, and control. Analyses revealed a main effect of condition on attentional focus ($p < .001$) and affect ($p = .011$) during aerobic exercise only. The music-video condition yielded the highest level of attentional dissociation while affect was more positive in the two experimental conditions when compared to control. RPE and heart rate did not differ across conditions. Post-session measures of exercise enjoyment revealed a main effect of condition ($p = .043$) and follow-up pairwise comparisons indicated that enjoyment scores were higher in the music-video condition when compared to control. There was an acute glucose-lowering effect of exercise in all conditions. Overall, results lend support to the notion that auditory and visual stimuli can enhance affective responses to exercise in a clinical setting. Nonetheless, such benefits were only realized during low-to-moderate intensity activity. These findings have implications for health outcomes and the promotion of exercise adherence in a clinical setting.

Cerebral mechanisms underlying music use during exhaustive exercise
Bigliassi, Marcelo, Karageorghis, Costas I., Nowicky, Alexander V., Wright, Michael J., Brunel University London; Orgs, Guido, Goldsmiths, University of London

The brain mechanisms by which music-related interventions ameliorate fatigue-related symptoms and enhance exercise performance during the execution of fatiguing motor tasks are hitherto under-researched. The objective of this study was to investigate the effects of music on electrical activity in the brain and psychophysiological responses during the execution of a fatiguing isometric ankle-dorsiflexion task that was performed to the point of volitional exhaustion. Nineteen healthy participants (10 men and 9 women; Mage = 26.4 years, SD = 3.6 years) performed two fatigue tests at 40% of maximal voluntary contraction while administered a musical excerpt or a no-music control condition. The well-known track Eye Of The Tiger by Survivor (109 bpm) was used as a distractive auditory stimulus. Electrical activity in the brain was assessed by use of a 64-channel EEG. Fast Fourier Transform was used to decompose the 1 s asynchronous samples into three wave frequencies (theta [3"8 Hz], alpha [8"12.5 Hz], and beta [12.5"35 Hz] bands); these were selected to facilitate investigation of how a musical excerpt might influence performance of a motor task. Attentional focus was assessed every 30 s during the motor task. Limb discomfort, situational motivation, affective valence, and felt arousal were assessed prior to and immediately after the motor task. The results indicated that, during the task, music down-regulated theta waves in the frontal, central, and parietal regions of the brain. Music also elicited a partial attentional switching from internal, task-related cues to external task-unrelated cues during exercise, which was associated with improvements in task performance. Moreover, participants experienced more positive affect while performing the isometric task in the music condition. In conclusion, music elicited a change in the predominance of low-frequency waves throughout the cortex and suppressed afferent cues (e.g., limb discomfort) in such a way that they remained outside of focal awareness over a broad spectrum.

Psychological and psychophysiological effects of recuperative music in repetitive high-intensity exercise

Jones, Leighton, Tiller, Nicholas B., Sheffield Hallam University; Karageorghis, Costas I., Brunel University London

Most of the research concerning exercise and music has focused on the ergogenic and psychological effects of music as a pre-task or in-task intervention (e.g., Hutchinson et al., 2011; Karageorghis & Jones, 2014). The application of music as a post-task or recuperative aid has received little research attention to date. This study sought to explore whether slow-tempo (55-65 bpm) or fast-tempo (125-135 bpm) music would promote more effective acute recovery in-between high-intensity running intervals. It was hypothesized that the music conditions would promote more pleasant affective responses during recovery and that slow-tempo music would elicit the most effective physiological recovery. Dependent variables included psychological (affective responses), psychophysical (RPE), and physiological (cardiorespiratory and blood lactate) measures. Following a music selection process, 13 male participants (Mage = 20.2 years, SD = 1.9 years; mean V"O2max = 62.6 ml"kg -1"min-1, SD = 6.1 ml"kg-1"min-1) were administered three conditions (no-music control, fast-tempo music, and slow- tempo music) in a randomized and partially- counterbalanced order. Each testing session comprised 5 x 5-min running on a motorized treadmill at an intensity of 20% of the difference between gas exchange threshold and V"O2max; intervals were interspersed with 3-min recovery periods during which participants were exposed to a control or music condition. Results indicated a significant ($p < .05$) main effect for Feeling Scale scores wherein fast-tempo music elicited higher scores than the no-music control. Significant ($p < .05$) Condition x Time interaction effects indicated that the control and slow-tempo music conditions led to more effective recovery of heart rate than fast-tempo music in the initial stages of the interval session. The present results indicate that fast-tempo music can enhance the high-intensity interval running experience, but that no- music and slow-tempo music promote more effective physiological recovery during the early stages of a high-

Motor Learning and Control

Performance of a texting task is influenced more by content than whole body motion: Standing vs. walking during a texting task.

Acharya, Prasanna K., Winges, Sara A., Louisiana State University

Texting has become popular with all age groups for quick communication, with young adults sending more than 100 messages daily. Texting is a repetitive tapping task accomplished while sitting, standing, or walking. It involves precise thumb movements across the keypad resulting from dynamic combinations of flexion/extension, abduction/adduction and rotation. As with many repetitive tasks, texting carries the risk of repetitive stress injuries which can be worsened by very quick repetitive movements. The purpose of this study was to examine how texting performance changes when standing versus walking and if the content influences performance. Ten healthy college students performed a one-handed texting task using iPhone 3GS. The task incorporated four different repetitive sequences of taps spanning the texting keyboard, a pangram sentence, and a short phrase more likely to be sent as a text message. Kinematics of the right thumb and whole body movement were recorded. Participants also completed a questionnaire on their texting habits and practiced the texting sequences prior to data collection. The specific hypothesis was that accuracy and speed of texting performance would be reduced when participants were asked to walk on a treadmill compared to standing. Changes in arm posture, and relative motion of the hand allowed during the task were also examined and compared between standing and walking conditions. Texting accuracy was not adversely affected by walking on the treadmill and there was not a significant difference in texting speed between standing and walking ($p>.05$). However, participants texted more slowly for four different repetitive sequences of taps even though the space between contacts points was closer for some of these non-word sequences compared to word-based sequences ($p<.001$). There was no significant interaction between texting sequence and condition ($p>.05$). Participants also held their arm rigidly and limited movement of the phone equivalently during both standing and walking conditions.

The effect of internal and external focus instructions and feedback on skill acquisition in children

Agar, Charles, Humphries, Charlotte, Hebert, Edward, Southeastern Louisiana University

Research has concluded that motor skill performance is enhanced when learners adopt an external attentional focus as compared to an internal focus (see Wulf, 2013 for a review). However, the results have been less conclusive with inexperienced learners (e.g., Beilock et al., 2002; Perkins-Ceccato et al., 2003), and there is limited research on this topic with children (Emanuel et al., 2008). This study examined if skill learning in children was differentially affected by providing instructions and feedback that direct attentional focus internally and externally, and if the effect of attentional focus varied between younger and older children. Forty-eight children in two age groups (5-8 and 9-12 years old) were assigned to either internal or external attentional focus conditions, and completed 30 trials of a shuffleboard accuracy task, followed 1-2 days later by retention and transfer tests. Prior to and during practice, instructions and feedback were provided using internal or external referents. Accuracy of trials improved with practice, and older children performed significantly better than younger ones. However, no significant differences between internal and external focus groups was found during acquisition, retention, or transfer. These results suggest that skill learning in children improves with task-based instruction and practice, regardless of the direction of attentional focus. More research is needed on the internal vs. external focus comparison studying children, and using skill level or stage of learning as a factor.

The effects of two stress types on motor learning and practice specificity

Aiken, Christopher, Alma College; Van Gemmert, Arend W. A., Louisiana State University

Research has shown that arousal levels adhere to the general idea of practice specificity, i.e., during practice and the test keeping arousal levels similar results in the best test-performance (Movahedi et al., 2007). One area that remains largely unexplored is the effects of increased work load or stress (which both are expected to modulate arousal

levels) on practice specificity. Therefore in this study it was examined whether work load and/or moderate stress added to a motor task in a motor learning paradigm would adhere to the general idea of practice specificity. 48 participants practiced a timed aiming task. Half the participants practiced and were tested on performing the aiming task singularly, while they performed the aiming task during transfer together with a secondary verbal mathematic task (transfer to work load: TWL) or when continuous white noise was presented (transfer to white noise: TWN). The other half of the participants performed the aiming task during acquisition, retention, and transfer together with the mathematic task (work load: WL) or while continuous white noise was presented (white noise: WN). All groups showed similar improvements in performance during retention and transfer as compared to baseline. However, during acquisition and retention WL had significantly greater absolute error (AE), constant error (CE), variable error (VE), normalized jerk (NJ), and reaction time (RT) in comparison to the other groups ($p < .001$). During transfer it was TWL exhibiting greater AE, CE, and RT ($p < .01$), while TWL also showed greater VE and NJ but only when compared to WN and TWN ($p < .01$). The results suggest that increasing work load during acquisition does not negatively affect motor learning. However when work load is added during a transfer test performance of the primary task is significantly hampered. These findings suggest that increased work load from adding a cognitive stressor does not adhere to the principle of practice specificity but increasing work load with the addition of a physical stressor does adhere to practice specificity.

Performance on a choice-reaction time task is not affected by physical stress in the form of high ambient temperature

Aiken, Christopher A., Alma College; Becker, Kevin A., Lee, Adrian, Texas Women's University; Post, Philip G., New Mexico State University; Van Gemmert, Arend W. A., Louisiana State University

The neuromotor noise perspective suggests that stress increases activation in the motor system. This activation can reduce reaction time (i.e., improve performance) or it can increase noise in the motor system (i.e., the activation is not related to the primary action goal). If noise needs to be reduced to cope with accuracy constraints of the action goal, the motor system has two options, either increasing processing time (i.e., noise levels out due to decay over time, while activation increases) or increasing limb stiffness, i.e., filtering out noise contributing to inaccuracy (Van Gemmert, 1997). Stress in the form of heat has been shown to degrade cognitive performance in some instances but more research is needed to better understand its effects on motor and cognitive performance (Hancock & Vasmatzidis, 2003). The purpose of this study was to investigate the effects of ambient heat on the performance of a nine-choice reaction time task at two different indexes of difficulty (ID: 3.64 & 6.17). 24 individuals performed 108 trials (6 trials to each possible target). Participants performed the task in both a heated room (42 deg C) and a control room (22 deg C). Individuals were randomly assigned to the order in which condition was performed first. 2 (condition) x 2 (ID) ANOVAs were applied to reaction time (RT), movement time (MT), and pen pressure (PP). A main effect of ID was observed for each DV. Movements to the higher ID was performed with longer RTs and MTs, and a higher level of PP ($p<.001$). The main effect of condition, and interaction of condition by ID failed to reach significance for all DVs ($p>.05$). These findings suggest that ambient heat did not impact motor performance. Increasing ID did however increase RT and PP, suggesting that an attenuation of noise in the motor system occurred. These results were in contrast to findings of previous studies showing that heat negatively impacts cognitive tasks. This relationship should be further explored in the future.

The level of vision necessary for optimal performance in rifle shooting: implications for Paralympic competition for athletes with vision impairment

Allen, Peter M., Anglia Ruskin University; Myint, Joy, University of Hertfordshire; Latham, Keziah, Anglia Ruskin University; Mann, David L., Research Institute MOVE Amsterdam

Background: Paralympic sports provide o for those who have an impairment that would otherwise be a barrier to participation in regular sporting competition. Rifle shooting represents an ideal sport for persons with vision impairment (VI) because the direction of the rifle can be guided by auditory information when vision is impaired. However, the level of vision impairment that would produce a practically significant reduction in shooting performance without auditory guidance (and therefore should represent the inclusion criteria for Paralympic competition) remains unclear. Materials and Method: Vision impairment in the form of blurred distance vision acuity (DVA) was simulated (with sim-specs) for nineteen international level shooters to determine the threshold

level of vision impairment at which performance becomes adversely affected. Results: A practically significant reduction in shooting performance was defined as the mean for three shots (with unimpaired vision) less 1.96 times the standard deviation across all participants. Shooting performance systematically decreased with reductions in DVA. When differentiating performance above and below the threshold level of practical significance, DVA reliably discriminated between acceptable and unacceptable performance, with the area under a Receiver Operating Characteristic curve being 0.88±0.03 (where 1.0 is perfect discrimination and 0.5 indicates no discriminative ability). The maximal Youden J of 0.62, indicating maximal sum of sensitivity and 1-specificity, was achieved with a cut off at 0.57 logMAR (approx. 6/24 or 20/80), which had sensitivity of 86% and specificity of 75%. Summary: The International Paralympic Committee has stated that VI shooting must develop its own sport-specific criteria for the 'classification' of athletes into fair classes for competition. The results of this study provide clear guidance for the level of impairment that should be necessary for athletes with vision impairment to compete in Paralympic shooting. *—IPC Shooting*

Adaptations in phase plane dynamics during postural-manual coordination in expert drummers
Amado, Avelino, van Emmerik, Richard, University of Massachusetts

In many activities of daily living control of manual movements needs to take into account postural fluctuations and adjustments that occur while standing. To build on the growing body of knowledge geared at understanding the integration between postural and manual coordination, Amado and colleagues (2016) had expert marching percussionists perform bimanual polyrhythms under different postural task constraints. They reported that the postural-manual coupling decreased as a function of manual task difficulty as well as the reduction in the area of the base of support. However, no changes were observed in the coordination between the arms (discrete relative phase) with changes in posture. Therefore the purpose of this research is to understand the effect of increasing postural difficulty on the continuous dynamics of the component oscillator in a bi-manual coordination task. We hypothesized that the variability in each of the component oscillators would increase with increasing postural difficulty. Twelve expert marching percussionists from the UMass Drumline performed a 1:1 (anti-phase) rhythm in one of four postures: seated, standing on two feet, standing on one foot, and standing on one foot on an air filled disk for 30s; each postural condition was performed three times. Deviation from the average trajectory in the position-velocity phase plane of each hand was used to assess changes in the continuous dynamics of the manual task. A one-way repeated measured ANOVA demonstrated that the deviation from the mean trajectory in the phase plane increased as the postural difficulty increased for both hands ($p < .001$), and this deviation was mainly driven by velocity changes ($p < .001$). This increased variability in the phase plane as a result of increased postural constraint is functional in light of the earlier observed preservation of the relative timing between the limbs in the Amado et al. (2016) study, and demonstrates how fluctuations at the level of the individual limb dynamics serve to maintain task performance in expert drummers.

Motor preparation is affected by physical inactivity in young adults
Anson, Greg G., Cirrillo, John, Srzich, Alexa, Finch, Jonathan B., University of Auckland

"Physical inactivity is the 4th leading cause of death worldwide" (Kohl, et al., 2012, Lancet, 380: 294-305). The effects of physical inactivity on cognitive performance are poorly understood. We measured simple and choice reaction time, and event-related potentials in 8 physically active (PA) and 8 physically inactive (PI) young adults (18-24 yrs) performing a key-press task. We used the International Physical Activity Questionnaire to screen participants before assignment to the PA or PI group. Physical inactivity was associated with significantly slower reaction time ($p<.05$), smaller contingent negative variation (CNV) amplitude and diminished lateralised readiness potentials. These results indicate that in tasks requiring rapid processing of precued information, physical inactivity impairs optimal motor preparation. Diminished CNV amplitudes associated with physical inactivity may signal reduced attention to motor preparation during the foreperiod following the precue before the imperative stimulus is presented.

Spatiotemporal gait parameters are affected by footwear stiffness in toddler-aged children.
Applequist, Bryon C., Kyvelidou, Anastasia, McCamley, John D., Myers, Sara A., University of Nebraska at Omaha

Footwear plays a significant role in, and can influence children's gait. Footwear type is especially important as a child grows and develops from a novice to an expert walker. Compared to barefoot walking, children generally have increased spatiotemporal (ST) gait parameters while walking with footwear. Gait variability has also shown to be affected by footwear. The degree of stiffness in footwear could have a large influence on children's gait and variability. This study investigated effects of footwear stiffness on ST gait parameters and gait variability (Standard Deviation (SD) and Coefficient of Variation (COV) in novice walkers. Children with an average age of 33.3 (+/- 7.0) months participated in a single data collection. Participants were acclimated to the treadmill while a self-selected comfortable walking speed was determined. Heel and toe marker positions were acquired for one minute of walking per condition using motion capture software. Participants walked on the treadmill wearing footwear with three levels of stiffness (rigid: hard-soled stiff shoe, semi-rigid: EVA sole athletic shoe, compliant: moccasin soft-sole shoe) and barefoot. ST gait parameters and gait variability were calculated for each condition. Stride length, step length, stride time, step time, stance time, and swing time all increased in the rigid and semi-rigid footwear conditions compared to soft-sole and barefoot. Interestingly, there were no differences between barefoot and wearing a moccasin for any of the ST variables. There were no differences in SD and COV between any of the footwear conditions. The moccasin shoe promotes walking most similar to normal barefoot walking, as evidenced by the agreement between ST variables. The moccasin shoes may allow a more natural flow of proprioceptive information while providing protection for the feet. Standard measures of variability failed to detect differences between footwear conditions. Further investigation into different methods is necessary to parse out what effect footwear has on children's gait variability. *—UNO Graduate Research and Creative Activity Award, Under Armour Footwear Fellowship*

Focusing on essential oils: Do they really make a difference?

Avans, Diana E., Martinez, Tiffanne, Ishizu, Kevin, Vanguard University

Essential oils have become increasingly popular. Studies have been conducted on the effectiveness of aromas on cognitive performance, perceived physical workload, and pain responses (Herz,2009). The purpose of this study was to test the claims made by 21drops© essential oil. 21 drops© claims their Focus Essential Oil blend promotes concentration and clarity. The blend contains rosemary to reduce fogginess, peppermint to stimulate the mind, and frankincense to induce clarity. Twenty two undergraduate students participated. They were randomly assigned to treatment or control. The participants were asked to take a pretest and a posttest of three computerized cognitive tests designed by Cambridge Cognition; Match to Sample Visual Search (MTS) which is a matching test, with a speed/accuracy tradeoff, Reaction Time (RTI) measures time to visual target when the stimulus is either predictable (simpleRT) or unpredictable (choiceRT), and Rapid Visual Information Processing (RVP) a visual sustained attention test. After the pre-test, the researchers applied the oils(treatment or placebo, randomized order) to the experimental and control group in a circular motion, five times each to the temples, side of the neck and the back of the neck according to the "focus" protocol. The participants were asked to inhale deeply after the application. All participants were then re-tested. Mann-Whitney U was used to compare the groups on the components of the 3 tests. There was no significant difference between the focus oil and the placebo on cognitive performance. There was a significant difference between the oil and control group for MeanSimpleRT ($p= 0.034$) and FiveChoiceMT ($p=0.019$). It should be noted that FiveChoiceRT approached significance ($p= 0.056$). There was no significant difference between the focus oil and the placebo on the components of the other tests. Our results showed that 21drops© focus essential oil has little effect on concentration/attention when applied as instructed, although we did have positive results relating to reaction /movement time.

The effects of brain games on memory in older adults

Avans, Diana E., Chavez, Caitlin, Ramirez, Bianca, Vanguard University

Previous studies on the effect of playing brain games on cognition have shown improvement in cognitive skills after gameplay (Nouchi et al. 2014; Nouchi et al., 2013). The specific aim for this research was to determine whether the Fit Brain application by RosettaStone improves memory in an older population. We recruited participants ages 55-70. All participants were required to work at least 20 hours per week at a paying job and have access to a smartphone, computer, or tablet. Thirteen individuals participate. Participants were randomly assigned to either the experimental or control group. Two computerized cognitive tests developed by Cambridge Cognition were

administered to each participant. The Delayed Match to Sample test (DMS), a test of simultaneous and delayed matching to sample assessing short term memory and the Spatial Span test (SSP), a test assessing working memory capacity. The experimental group was instructed to play two games on the Rosetta Stone Fit Brain app, chosen for their similarity to the cognitive assessment, for 15 minutes a day, five times a week for four weeks. At the end of the four weeks, both groups returned for posttests. A Mann-Whitney U Test was conducted to determine the effect of the game playing on working memory. There were no significant effects of the brain game application on working memory compared to the control group. The results for DMS percent correct, DMS percent correct (all delays), and Span Length were not significant; however, the result for DMS percent correct (simultaneous) approached significance ($p= 0.051$). There was insufficient evidence from this study to support the claim that playing the Fit brain games improves working memory. Similar results were found using groups of traditional undergraduate students (Avans, Johns, Roh, & Sanchez, 2015). Although previous literature suggests that brain games benefit overall brain health (Fernandez, 2006), the results from this study do not support that claim. Further controlled, study is warranted over a longer period of time to determine effectiveness of the games.

An examination of goals, strategies, and information processing in a self-control protocol

Bass, Andrew D., Fairbrother, Jeffrey T., Von Lindern, Aaron D., University of Tennessee-Knoxville

Research in motor learning concerning the mechanism of self-controlled (SC) feedback has speculated that individuals given the option to control their feedback schedule may engage in deeper levels of information processing (Janelle et al., 1997). The purpose of the study was to examine goals and strategies of individuals in a SC protocol. 27 participants were recruited and asked to learn a sequential timing key pressing task. Participants were given three goals: react quickly, obtain individual segment times, and reach an overall time. Participants were allowed to request feedback in the form of KR regarding each of the three goals after any trial. Acquisition consisted of six 10-trial blocks. Retention and transfer consisted of 10 trials administered approximately 24 hours later. Retention mirrored acquisition, except no feedback was administered. Transfer had the same procedure as retention with the exception of the task, which required different segment times. Results revealed that participants chose to focus on only one or two of the three goals suggesting they may have implemented individual strategies for managing information processing. Furthermore, the information processing explanation of SC benefits suggests that participants may pay more attention to planning and processing related to feedback within the decision to ask for it and the subsequent interpretation. Decision to focus on specific goals rather than all three could provide rationale as to the management of attention during the verbal acquisition stage of skill acquisition as a means of information facilitation. Also, many participants ($N= 19$) reported focusing on the “rhythm” or “timing” of the movement X^2 (1, $N= 27$) = 4.48, $p<.05$ as a strategy for learning while many ($N= 20$) also chose to focus on one or two goals versus all three X2 (1, $N= 27$) = 6.26, $p<.05$. Overall, the findings suggest that learners who are allowed to control their feedback schedule may engage in different strategies and information processing management as a means of enhancing the effects of SC learning.

The influence of external and internal focus of attention exercise on symptoms and automaticity in Parkinson’s disease: A single blind randomized controlled trial

Beck, Eric N., Intzandt, Brittany N., Almeida, Quincy J., Movement Disorders Research and Rehabilitation Centre, Wilfrid Laurier University

Due to its progressive degeneration, individuals with Parkinson's disease (PD) lose the ability to walk automatically, placing greater demand on attentional resources and increasing risk of falls. However, using attention-focused exercise strategies to improve walking without the need for conscious control might be possible. One avenue to accomplish this may be to foster an external focus of attention (EFA, focus on manipulated entities), argued to promote an automatic form of movement control, as opposed to an internal focus of attention (IFA, focus on one’s limb movements). The current study aimed to investigate the influence of chronically training with an EFA compared to IFA on symptom severity and gait automaticity (dual task walking) in those with PD. Thirty-one participants with PD completed 33 one-hour goal-based exercise sessions over 11 weeks while either focusing attention i) externally on stickers attached to their limbs (EFA, $n=15$) or ii) internally on their limbs (IFA). Before and after (pre/post) program completion, symptom severity (UPDRS-III) was assessed ON and OFF dopamine replacement, and spatiotemporal gait patterns were measured during single and dual task walking. A main effect of

time demonstrated that both EFA and IFA groups significantly reduced symptom severity after training (p<.01). However, OFF meds, the EFA group improved by 6.2 points post exercise, whereas the IFA group improved by only 2.2 points on the UPDRS-III, which is a clinically relevant difference between groups. A significant interaction between group, time, and task was found for double support % variability (DSV) showing that dual tasking resulted in significantly greater DSV compared to single task gait only at post in the EFA group (p=.03). Together, since increased DSV has been proposed to reflect greater proprioception sampling, and OFF medication symptom severity improved more in the EFA group, results will be explained in terms of improved processing of proprioception. Increased sampling of proprioception may be a prerequisite to improved automaticity of gait.

The influence of dopaminergic modulation on internal and external focus of attention during postural stability tasks in Parkinson's disease

Beck, Eric N., Almeida, Quincy J., Movement Disorders Research and Rehabilitation Centre, Wilfrid Laurier University

The basal ganglia (BG) are believed to help automate the control of well-learned movements. It's been argued that when we focus externally (on objects to be acted on), this promotes automaticity, while focusing internally (focusing on specific aspects of the limbs) leads to greater conscious control. As a result of BG degeneration, individuals with Parkinson's disease (PD) are impaired in their ability to control well-learned movements. For example, dopaminergic medication allows PD to improve postural stability when using an external focus of attention (compared to internal focus), but it is not clear if an external focus would provide the same benefits in the absence of dopamine. Thirteen PD stood still for 30 seconds on a firm but unstable platform (Biodex Balance System) in 3 conditions: i) external focus of attention (EFA), ii) internal focus of attention (IFA), and iii) no instruction (control) for 3 trials each, both ON and OFF meds. The balance system provided a postural stability index (PSI) as an average (displacement) and standard deviation (variability) of the overall, anterior-posterior (AP), and medial-lateral (ML) postural sway. When OFF, interactions between condition and trial showed greater sway and more variable sway during EFA, in the first trial compared to last (p<.04). Significant interactions between meds and condition for AP PSI displacement and variability demonstrated that when ON, IFA and EFA resulted in significantly greater displacement and variability of sway compared to OFF IFA (p<.02). ON IFA demonstrated significantly greater sway displacement compared to OFF EFA (p=.02). Since OFF EFA resulted in worse postural stability in the first trial, an impaired automatic system may have been initially recruited, but later avoided for the use of an alternative strategy that bypasses the broken basal ganglia. Improved postural control when OFF and IFA supports the conclusion that a strategy that bypasses the use of the broken BG might have been adopted when OFF; and when ON, PD use the BG causing detriment to postural control.

High ambient temperature levels do not influence motor learning

Becker, Kevin A., Texas Woman's University; Aiken, Christopher A., Alma College; Rodriguez, Xochilt, Texas Woman's University; Van Gemmert, Arend W. A., Louisiana State University

The relationship between stress and motor performance is complex with stress both improving and degrading performance (Van Gemmert & Van Galen, 1997). While stress and performance has garnered substantial attention in the literature, its effect on motor learning has scarcely been explored. Aiken and Van Gemmert (2015) tested the impact of cognitive (secondary arithmetic task) and physical (white noise) stress on motor performance and learning. Their findings indicated that only cognitive stress hindered performance, and neither stressor influenced learning. The purpose of this study was to determine if a different type of physical stressor (heat) would influence the performance and learning of a motor task. Participants (N=24) were randomly assigned to either a heat stress (HS) or control (CON) condition and learned to draw a line between two targets in exactly 2000ms while avoiding two barriers. The task was completed in a room set at either 42 deg C (HS), or 22 deg C (CON). Acquisition consisted of 60 trials followed by 6 trial retention and transfer tests. Absolute, constant, and variable error (AE, CE, & VE) were calculated. Reaction time (RT) and average axial pen pressure (PP) were also analyzed. For each variable, separate ANOVAs were performed on acquisition data, and ANOVAs were performed on retention and transfer data. Results indicated a significant block effect in acquisition on AE, CE, VE, and PP (p<.05) with participants improving from the first to last block of acquisition. Group effects and block x group interactions for all DVs in acquisition failed to reach significance (p>.05). The same pattern of findings was also observed for retention

and transfer. Possibly hydration did mediate the effects of heat stress. However, the findings are consistent with the findings of Aiken and Van Gemmert (2015), who also showed that physical stress does not impact motor learning. Future work should consider whether heat stress in combination with dehydration impacts motor learning and performance.

Transfer effect of adaptation of the dominant hand to the other in individuals with probable DCD

Bo, Jin, Lee, Chi-Mei, Eastern Michigan University

Developmental Coordination Disorder (DCD) is a pervasive disorder that can persist into adulthood. Our previous study showed that adults with probable DCD (as assessed by the Adult DCD/Dyspraxia Checklist, ADC, Kirby et al., 2010) had less adaptability when error feedback was regular (gain = 1:1), but reached a similar level of adaptability compared to the controls when feedback was enlarged (gain = 1:2). The current study examined the between-hand transfer effect among adults with (n = 11) and without DCD (n = 16) after they adapted to visuomotor distortions using their dominant hand when error feedbacks were either regular or enlarged. We predicted that while controls had positive transfer to their non-dominant hand regardless of feedback conditions, individuals with DCD would show no transfer when error feedback was regular. Positive transfer effect could only be found in the enlarged feedback condition due to the successful adaptation with their dominant hand. Interestingly, results revealed that both groups with and without DCD demonstrated positive transfer in both feedback conditions on all the variables. Interactions between group (DCD vs. controls) and feedback condition (regular vs. enlarged) were not found (all ps > 0.05). It appears that regardless of feedback conditions, individuals with probable DCD could develop a relatively stable visuomotor mapping after being exposed to distortion. Furthermore, they were able to transfer their learning from dominant hand to non-dominant hand.

The influence of feedback on joint angle exploration when learning to control a complex tool

Bongers, Raoul, University of Groningen

The current study examined processes of exploration in a task where the use of a complex tool is learned. Exploration is the variability in joint angles resulting from the search for and use of a solution space of a task. The solution space is that subspace of the joint space for which the joint angle combinations bring the end-effector to the goal position. Exploring joint angle combinations reveals the solution space for this task. The solution space depends on the use of a tool, that is, when using a tool the end-effector of the action system is displaced from the hand to the tool and properties of the tool affect the mapping between hand movements and end-effector movement. We used a two-sided sliding lever as a tool that has a complex mapping between hand movement and end-effector movement. Participants had to learn to make point-to-point movements with the tip of the tool. To do that they had to explore the arm's joint angle combinations to learn coordinative patterns that move the hand in such a way that the tip of the lever reaches a target. The current study asked how these explorative processes were affected by the feedback provided. In our aiming task with a tool we used two conditions: i) continuous visual feedback of the tip of the lever was provided, and ii) only terminal visual feedback (i.e., end position of the lever's tip) was available. The Uncontrolled Manifold Method was used to partition variability in joint angles of the arm in exploration within the solution space (Expl-in) and in exploration outside the solution space (Expl-out). Over all conditions Expl-in was larger than Expl-out and their ratio was unaffected over conditions. With only endpoint vision both measures of exploration were largest at the beginning of learning and decreased to the lowest values at the end of learning. In the condition with continuous vision the change in exploration over learning was smaller. This suggests that exploration is higher when only feedback about the achieved end-position is provided than when feedback is provided continuously.

Single and dual leg Fitts task: Is two better than one?

Boyle, Jason B., The University of Texas at El Paso; Wang, Chaoyi, Texas A&M University; Gamez, Alejandra, Ables, Alicia, The University of Texas at El Paso

Experiments investigating single and dual limb movements have demonstrated a coordinate coupling effect. This is specifically seen when the hands are asked to make independent movements to low index of difficulty targets with one hand while simultaneously making movements to high index of difficulty targets with the other hand. As highly

investigated as this topic is, little to no research has investigated how this paradigm applies to coordination of goal directed leg movements. A study of 13 volunteers involved participants completing right and left single leg movements to a target (W=3in) positioned directly below them on the ground at differing amplitudes (A=9in, 18in) away from the midline. The participants also completed dual leg movements under the same task conditions. Finally, to investigate coordinate coupling in the legs, participants alternated between mixed dual leg trials, with a single leg moving to the small amplitude target while the opposite leg moved to the larger amplitude target simultaneously. Positional data of the entire body was recorded by an Optitrack motion capture system (motive software) and data analysis of movement time was analyzed through MATLAB. Repeated measures analysis of variance revealed no differences in movement times in the single leg tasks when comparing left and right however, the dual leg tasks (at the same amplitude) produced faster movement times when compared to making single leg movements. In other words, the legs moved faster when moving together than single at both the small amplitude and large amplitude condition. Furthermore, coordinate coupling was also displayed in the mixed amplitude condition. Discussion points and future investigations will examine the role of center of mass and body positioning as it relates to balance and movement preparation in single and dual leg movements.

The effect of task difficulty on center of mass loading in a forward leap

Boyle, Jason B., Sullivant, Frank, Yang, Feng, The University of Texas at El Paso

Since its publication over 60 years ago, Paul Fitts paper, now respectfully referred to as Fitts Law, has produced thousands of studies that conclude goal directed movement is governed by a speed-accuracy trade-off (Fitts, 1954). Although these findings have been highly replicated, a number of studies have also produced results that do not reflect the trademark linear result. Recently, a study by Juras, Slomka & Latash (2009) examined the speed-accuracy trade-off relationship in a two footed forward leap task and concluded that movement time does not change with increasing task difficulty. These findings led the authors to conclude that a violation of the law had occurred. To further these findings, an experiment was conducted to analyze how task difficulty affects whole body preparation in the loading phase prior to a two footed forward leap. A study of 10 subjects involved participants performing a two footed forward leap at amplitudes (A) 30% or 60% of individually established max voluntary horizontal distance paired with target widths (W) 6in (large target) or 3in (small target). Participants performed 10 jumps at each scenario, totaling 40 jumps in all. A custom designed Matlab program was used to calculate the body's center of mass (COM) by analyzing 38 individual reflective marker points on the body (Optitrack Motive) recorded at 120 samples/sec. A repeated measures analysis of variance revealed no differences in COM at either target width (3in or 6in) in the 30% amplitude condition however, concluded that COM was significantly lower in the 60% amplitude conditions with the smallest target combination (3in) producing the lowest COM. These results potentially point to a pre-planned motor program reflecting an inverse linear relationship of COM with task difficulty.

Sequence-induced anticipatory behaviour: Training with contextual information

Broadbent, David P., Brunel University; Ford, Paul R., University of Brighton; Williams, A. Mark, Brunel University; Causer, Joe, Liverpool John Moores University

Researchers who have examined the utility of anticipation training have predominantly focused on the use of advanced postural cues. In contrast, few researchers have considered the influence of contextual (non-kinematic) sources of information. We use a novel approach to examine the role of sequence-induced contextual information on the retention and transfer of anticipation judgements in tennis. Intermediate level tennis players (N = 21) were required to anticipate and move in response to life size video from a first person perspective of opponents playing a sequence of shots. During practice, participants viewed the tennis shots in either a non-sequential order, containing only postural cue information, or in the sequential rally order, which provided additional information such as court positioning and relative movements of the ball and opponent. The final shot in each sequence was the same for both groups and was occluded. Response accuracy was collected on a pre-test, across practice and on a 7-day retention test which contained both sequential and non-sequential trials. Decision time was collected in a field-based test to examine transfer of learning. No differences were observed between groups on either pre-test condition. In the sequential retention test the sequential group was significantly more accurate than the non-sequential group. However, in the non-sequential retention test the sequential group reverted back to its pre-test level suggesting an over reliance on the additional information. In the field-based transfer test the sequential group significantly reduced

its DT on all shots from pre-test to transfer test compared to the non-sequential group. Findings demonstrate the performance advantage gained from incorporating sequence-induced contextual information into simulated practice providing the additional information remains present in the retention and transfer conditions. Findings have implications for research on anticipatory behaviour and the design of appropriate practice activities that replicate the processes that occur in competition.

Multitask-integration facilitates implicit motor learning

Broeker, Laura, Raab, Markus, German Sport University Cologne; de Oliveira, Rita F., London South Bank University; Hegele, Mathias, University of Giessen; Schorer, J, Carl von Ossietzky University Oldenburg

In this study we explore how dual task integration, triggered by structural similarity of the primary and secondary task, facilitates implicit motor learning. We were particularly interested in how manipulating motor load in a dual-task situation affects learning of a constant segment embedded in a pursuit tracking task. Furthermore we examined if dual-task effects could be attributed to task integration by temporally correlating task characteristics and increasing difficulty of primary and secondary task. Whilst in Experiment 1 one group of participants, the single group, performed a pursuit tracking task only, another (the "random") group executed the tracking task while simultaneously counting randomly presented high-pitch tones plus ignoring random low pitch tones. The last group, the structure group, received random low-pitch tones plus high- pitch tones that were temporally coupled to the tracking task and occurred 250ms before each extreme of the curve. In Experiment 2 the motor difficulty of the secondary task was increased. Participants now had to tap one foot on high pitch and the other foot on low pitch tones. In Experiment 3 the difficulty of the primary task was also increased by instructing participants to use their non-dominant hand. Results indicate that implicit motor learning depends on the difficulty and similarity of both the primary and secondary tasks. Learning is hampered in the presence of a dual task but only when there is no structural similarity between primary and secondary task and no stringent sensory-motor load forcing participants to exploit optimization strategies. Our results support theories of task integration in terms of beneficial effects of temporal correlation between tasks. Other types of integration such as predictability or automaticity need further research.

Observation viewpoint (1st or 3rd person) interacts with model skill level to influence strategy selection and coordination accuracy/stability in a bimanual task

Buchanan, John J., Texas A & M University

This study examined the interaction between viewing perspective and model skill level on learning a bimanual motor skill through observation. The task was to trace two circles using a relative phase pattern of 90 with the right-arm (RA) leading the left-arm (LA). The RA was to trace counterclockwise (CCW) and the LA clockwise (CW), a CCW:CW directional strategy. Half of the observers (N=16) had a 1st person view and half a 3rd person view of a model. In each viewing group, half the observers watched an expert (N=8) and half a novice model. All observers saw a video of 96 performance trials with 48 trials seen in each of two sessions (a day apart). The expert traced the circles with a RA lead and used the CCW:CW strategy. The expert's average mean relative phase was 91(AE = 3 deg) across trials. The novice used a variety of strategies early in practice and did not stay with a RA lead and a CCW:CW strategy until the last 40% of the trials, with relative phase AE dropping from the first ten (AE = 29 deg) to last ten trials (AE = 8 deg). Observers were not told the task goals or the model's skill level and were instructed to learn the bimanual pattern demonstrated by the model, and were given a retention test 24 hours after the second observation session. An analysis of relative phase revealed that observers with a 1st person view had smaller AE and spent more time on task compared to observers with a 3rd person view. Observers with a 3rd person view of the novice had the largest AE and spent less time on task compared to the other groups. Directional strategy choice was not influenced by model skill level or viewpoint as evidenced by use of the CW:CCW strategy on 99% of the retention trials. However, model skill level and viewpoint influenced the percentage of times a RA lead was used across trials: 3rd person view of expert 12%, 1st person view of expert 64%, 3rd person view of novice 78%, and 1st person view of novice 100%. The results show that an observer's viewpoint and a model's skill level interact to influence observation.

Proactive influences in the coordination dynamics of bimanual patterns

Buchanan, John J., Park, Inchon, Chen, Jing, Wright, David L., Texas A&M University

A consistent finding in the study of bimanual coordination is that in-phase (IP) is more stable than anti-phase (AP). This experimental finding is consistent with the theoretical predictions of the HKB model of the dynamics of relative phase. The dynamics of IP and AP have been shown to be influenced by learning, directed attention, and intention. In this study, we examined the influence of prior performance on current performance. In the literature, the impact of prior performance on current performance is most often addressed within the context of pro-active interference. The typical finding is that the first task interferes with recall of the second task. IP and AP do not require extensive training and the HKB model does not take into account the impact of any one pattern on another except with regard to attraction which is governed by pattern stability. In the current task, participants were put into two groups: 1) IP-to-AP, performed 5 trials of IP followed by 5 trials of AP with a 2 minute break between trials; 2) AP-to-IP, performed in the opposite order to the IP-to-AP group. The primary dependent measures were relative phase variability and movement frequency. Overall, IP was more stable than AP and was performed at faster movement frequencies. When AP was performed after IP (IP-to-AP), movement frequency of AP was faster and relative phase variability was larger (less stable) than when AP was performed first. When IP was performed after AP (AP-to-IP), movement frequency of IP was slower and relative phase variability decreased (more stable). Thus, performing a more stable pattern first (IP) resulted in less constrained performance of a less stable pattern (AP) with a cost in terms of decreased stability. Whereas performing a less stable pattern first, led to a more constrained production of a more stable pattern with a benefit in terms of increased stability. The data revealed a proactive calibration of one intrinsic pattern on another that did not violate the basic theoretical features of the HKB model.

Objectifying comfort: investigating physiological explanations for the adoption of different grip selection strategies

Burgess, Raquel, Cappelletto, Jessica, Skultety, Jessica K., Lyons, James L., McMaster University

Recent evidence from our lab (Burgess et al., 2014), suggests that the relative location of the task goal in a movement sequence may be a better predictor of grip selection strategy than the end-state of the task; we have termed this the goal-state comfort effect. In addition, the likelihood of observing either end-state or goal-state grip selection strategies is mediated by the location of the manipulated object relative to the participant (i.e., in ipsilateral or contralateral space). The behavioural transitions observed when switching from a comfortable (thumb-up) to an uncomfortable (thumb-down) grip posture may occur due to the functional costs associated with each grip strategy (see also Rosenbaum's computation model, 1992). Questions remain, however, as to which objectively measureable physiological and/or biomechanical variables contribute to the costs that are interpreted subjectively as 'comfort' by participants in such tasks. To address this, our study investigates the relationship between maximal grip force production and discomfort in TU and TD postures along the ipsilateral to contralateral continuum. Ten participants performed maximal grip exertions at six specific spatial locations along this continuum and indicated their perceived discomfort in each posture on a visual analog scale. Results suggest that TD positions correspond to significantly lower force production ($p<.0001$) and higher perceived discomfort ($p<.01$) than TU positions. In addition, lower force production and higher perceived discomfort are associated with contralateral positions when compared to ipsilateral positions. As expected, maximal force production is significantly correlated to perceived discomfort, such that discomfort increases as force production declines, $r = -0.556$, $p<.0001$. These results are discussed in the context of muscle force-length relations as a mediator of observable grip behaviour strategies and the subjective perceptions of comfort associated with these strategies.

The influence of working memory capacity on children's motor learning: Evidence from a basketball task

Buszard, Tim, Victoria University; Masters, Rich S.W., Waikato University; Verswijveen, Simone, Farrow, Damian, Victoria University

Although it is generally accepted that certain practice conditions can place large demands on working memory when performing and learning a motor skill, the influence that working memory capacity (WMC) has on the acquisition of motor skills remains unsubstantiated. This study examined the role of WMC in a motor skill practice context that promoted working memory involvement through the provision of explicit instructions. It was predicted that children

with low WMC would not learn as effectively as children with high WMC, as such an instructional approach would place an excessive burden on their working memory resources. A cohort of 90 children aged 8 to 10 years completed two measures of WMC. Children that scored in the lowest and highest quartiles were allocated to the low WMC ($n = 24$) and high WMC ($n = 24$) groups respectively. The motor task required children to practice basketball shooting for 240 trials in blocks of 20 shots, with pre- and post-tests occurring before and after the intervention. A retention test was also administered one week after the post-test. Prior to every practice block, children were provided with 5 explicit instructions that were specific to the step-by-step processes of shooting a basketball. It was envisaged that these instructions would aid learning if used effectively. Preliminary results revealed differences between the two groups, with a 2 (Group) x 3 (Time) Mixed ANOVA highlighting a significant Group x Time interaction [$F(2,88) = 6.75$, $p < 0.01$]. While the High WMC group displayed consistent improvements from pre- to post-test and through to the retention test, the opposite effect occurred with the Low WMC group, with performance declining from the pre- to post-test and further deteriorating in the retention test. This implies that the explicit instructions had a negative influence on learning for the Low WMC children. Discussion will focus on the role of WMC when learning motor skills in highly explicit environments and the implications for practitioners working with low WMC children.

On the relationship between bodily processes and perceptual estimates of action-relevant space
Canal Bruland, Rouwen, Vrije Universiteit Amsterdam

Perceptual estimates of action-relevant space have been reported to be modulated by bodily processes such as motor performance and postural stability. These findings seem to provide support for the idea that perception may be embodied. Here I present two studies in which my collaborators and I failed to find a) that variability in performance may scale reported target size in an aiming task, and b) that systematic differences in postural stability modulate perceptual estimates of action-relevant space. In both studies perceptual estimates remained stable in the face of systematic differences in variability of performance and postural stability. Together, these findings add to an increasing body of literature questioning the empirical robustness of previously reported effects that support an embodied view of perception.

Reduction of pelvis rotation during treadmill walking: Implications on upper limb kinematics and muscle activity
Canton, Stephen P., Kessler Foundation; MacLellan, Michael J., Louisiana State University

Current debate questions whether upper limb swing during human locomotion originates from passive mechanics or active neural drive. Evidence supporting the passive mechanics hypothesis suggests that arm swing originates from energy that is transferred upward through the body by the swinging lower limbs, while the active hypothesis suggests arm swing originates through neural linkages between the upper and lower limbs. The present study aimed to challenge the passive mechanics hypothesis by reducing transverse rotational motion at the pelvis, subsequently decreasing the upward mechanical energy transfer, and to determine the effects on upper limb kinematics and muscle activities. To this end, ten healthy young adults walked on a treadmill at speeds of 2, 3, and 4 mph with and without a pelvic harness strapped to an external frame (to reduce transverse pelvis rotation). Full body 3-dimensional kinematics and muscle activities from 12 muscles on the right side of the body were recorded. Results showed that arm swing amplitude increased during faster treadmill speeds, but this increase was greater when walking without the pelvic harness compared to when pelvis rotation was reduced. However, muscle activity amplitudes were generally similar between the natural and reduced pelvis rotation conditions at each treadmill speed. In addition, temporal patterns of upper limb kinematics and muscles activities were conserved between the natural and reduced pelvis rotation conditions. The similar muscle activities that accompany reductions in arm swing amplitude when transverse rotational motion at the pelvis was reduced suggests passive mechanics are a fundamental component to arm swing amplitude during human locomotion, while the neural activations may preserve the temporal aspects of upper limb swing. The results in the current study can be used to guide future modelling studies in order to determine the separate contributions of active and passive components to arm swing during locomotion in differing modes and speeds.

Don't fence me in: Does perception of stimulus closure contribute to illusory biases in Muller-Lyer configurations
Cappelletto, Jessica, Roberts, James W., Lyons, James L., McMaster University

While perceptual misjudgements of the Muller-Lyer (M-L) illusion are typically attributed to the length of the figure shaft (e.g., Mack et al., 1985), others have suggested that the behavioural biases seen during goal-directed aiming to a M-L figure can be ascribed to a misperception of the position of the target endpoints (e.g., Glazebrook et al., 2005). Here we suggest a third possibility: Gestalt principles of closure would suggest that the tails located at the terminus of M-L configurations present to the observer a perceptual target boundary that effectively creates a closed target space, which functions to draw the aiming movement forward (tails out) or backward (tails in) toward the target. As such, we hypothesize that M-L figures presented with a tails-in or T-shaped endpoint configuration serve to provide such a perceptual boundary wherein movements beyond the target endpoint are inhibited. Conversely, figures with tails-out or X-shaped endpoint configurations would extend the perceptual target space beyond the M-L vertex. Fourteen participants (25.4+/-2.9 years, 6 males) performed horizontal 25 cm manual aiming movements to both the anterior vertex of a M-L figure and to individual chevrons (i.e., the M-L figure without the shaft). Trials thus included 8 stimuli that were a combination of 4 configurations (tails-in, tails-out, X, T) and 2 shaft conditions (shaft, no shaft). Consistent with our hypothesis, movement amplitude was affected by the stimulus configurations,

with the tails-in and T configurations resulting in greater undershoot magnitudes than tails-out ($p<0.001$). In addition, movement biases unfolded at peak deceleration and continued until the end of the movement, consistent with evidence that movement execution is susceptible to illusory influences ($p<0.005$). Of greater interest was the finding that this pattern of results held regardless if a shaft was present in the aiming movement, perhaps suggesting that the closure induced by the target configuration is contributing to the misperception of target location.

Not all choices are created equal: The differential impact of task-relevant and task-irrelevant choices on motor learning

Carter, Michael J., Elnakouri, Abdo, Yantha, Zachary, Ste-Marie, Diane M., University of Ottawa

Lewthwaite et al. (2015) recently reported that the learning benefits of exercising choice are not restricted to task-relevant features (e.g., self-controlled feedback). Specifically, it was found that being able to choose the color of golf ball (Experiment 1) or choosing which of two tasks to perform at a later time plus which of two paintings should be hung in the laboratory (Experiment 2) resulted in better learning outcomes than being denied this opportunity (i.e., yoked condition). These findings led Lewthwaite et al. to conclude that motor learning benefits stemming from choice, whether unrelated or related to task performance, are motivational because choice is inherently rewarding and satisfies a psychological need for autonomy. However, the absence of a group that made task-related choices and no inclusion of a measure of autonomy significantly weakens this claim. Here, we investigated if choices related and unrelated to task performance do in fact produce similar learning benefits. Participants practiced a spatiotemporal motor task in one of 3 groups: 1) Choice over feedback schedule (Task-relevant), 2) Choice over the color of pro-wrap that was put on their arm plus which of two video games to play at a later time (Task- irrelevant), and 3) a No-Choice yoked group. Importantly, all participants practiced with a relative feedback frequency of 33%; thus, participants in the task- irrelevant and yoked groups replicated the feedback schedule of a participant in the task-relevant group. Contrary to the Lewthwaite et al.'s conclusion, task- relevant and task-irrelevant choices did not result in similar learning outcomes. Instead, the data revealed significantly greater learning in the task-relevant group compared to both the task-irrelevant and yoked groups (p values < .05), who did not differ significantly from each other. Moreover, our measure of autonomy did not reveal any significant differences between the groups. These results add to the growing evidence that the motivational account for the learning benefits of task-related choices is inadequate.

Cognitive priming facilitates rehabilitation in chronic stroke motor recovery

Cauraugh, James, Kang, Nyeonju, Idica, Jerelyne, Bhullar, Amitoj, University of Florida

Stroke is one of the most common causes of motor disabilities in North America. Unfortunately, nearly 80% of the survivors still suffer from motor impairments one-year post. Even though various approaches report progress toward motor recovery, the search for more effective behavioral interventions for the upper extremities continues. The current study introduced a novel intervention by asking whether cognitively priming the nervous system with Brain Fitness computer training (Posit Science) facilitated stroke motor recovery. Participants completed 60 minutes of cognitive Brain Fitness training before receiving 90 minutes of coupled bimanual movements with active stimulation assistance (BMAS) rehabilitation. Chronic stroke individuals (N = 30) volunteered for two and one-half hours of interventions on one day/week for six weeks according to randomly assigned groups: (a) cognitive priming plus BMAS, (b) BMAS only, and (c) control. A mixed design two-way ANOVA revealed a significant Group Test Session interaction on the Box and Blocks test. The cognitive Brain Fitness plus BMAS group moved nine more rcontrol group. Analyses of the fractionated reaction time components indicated similar findings for the median motor reaction times. The cognitive primed group improved their motor reaction times by 37 ms from pretest to posttest. Analysis of the median force production data in a three-way Group Hand Position Test Session (2x2x2) ANOVA with repeated measures on the last two factors revealed higher force output with two hands versus one hand: (a) bimanual: M = 69 N; SD = 35; 95% CI: 58 "to 76 N), and (b) unimanual: M = 59 N; SD = 31; 95% CI: 51 to 68 N. Together, performances on the motor capability tests by the cognitive Brain Fitness plus BMAS group indicate that priming the nervous system is a viable intervention to facilitate motor recovery progress in chronic stroke.—*AHA*

Stimulus or response based sequence learning is determined by temporal placement of a preceding focused attention meditation.

Chan, Russell W., Immink, Maarten A., Lushington, Kurt, University of South Australia; Mosewich, Amber D., University of Alberta

Cognitive control processes that regulate attention, perception, and memory systems influence whether motor sequence learning and representation is primarily stimulus or response oriented. Since cognitive control processes are shared amongst goal-directed tasks, adoption of stimulus or response based sequence learning might be influenced by preceding cognitive tasks. The potential to prime stimulus or response based sequence learning modes was investigated in the present experiment through pre-training exposure to a focused attention meditation technique. Prior to a serial reaction time task (SRTT), 36 meditation naive adults experienced one of three experimental conditions. The MED group completed the 20-minute meditation immediately before training while the MED-D group received a 20-minute delay between meditation and training. No meditation was provided to the NoMED group prior to SRTT. All groups demonstrated significant reaction time (RT) reductions due to the second-order conditional (SOC) sequence embedded in SRTT blocks. Significant group performance differences were revealed only in the final SOC block. Here, RT was significantly longer for the NoMED group than the MED and MED-D groups, which did not differ significantly. A comparison of performance between the final SOC block and a subsequent random sequence block revealed a significantly greater RT increase for the MED-D group than the other two groups while RT increase was significantly greater for the NoMED group than the MED group. After completion of the SRTT, percent recall of the SOC sequence was significantly lower for the MED group than the MED-D and NoMED groups, which did not differ significantly. As an attention orienting task, meditation appears to promote subsequent sequence performance, particularly in later task stages. However, these performance benefits are primarily due to stimulus- based planning when meditation immediately precedes sequence learning whereas a delay between meditation and sequence learning allows for performance gains due to greater response-based planning.

Context interference effect on motor chunk

Chen, Jing, Texas A & M University; Shanghai University of Finance & Economics; Kim, Taewon, Jo, Ji Seong, Wright, David L., Texas A & M University

The contextual interference (CI) effect references the general observation that random practice (RP) of motor tasks induces superior learning than that practice conducted in a repeated order referred to as blocked practice (BP). Recent evidence, using neurophysiological assessment, has attributed at least part of this effect to enhanced retrieval from experiencing RP. The present work, adopts a behavioral approach based on recent work of Abrahamse et al (2013) addressing the learning of discrete sequence production (DSP) tasks. This account argues that initiation, concatenation and execution are independent processes central to the production of this type of motor skill and each process can be isolated by using pre-structured motor sequences. Pre-structured sequences encourage the learner to perform motor skills in pre-determined groups of two or three-element chunks. Assuming that RP influences retrieval, it was anticipated that the initiation and concatenation, processes described as involving some form of retrieval by Abrahamse et al., should be particularly susceptible to the learner's practice schedule. To assess this issue, participants performed three different pre-structured 6-element DSP tasks, created by using of non-aging RSI's at appropriate points in sequence presentation, to be performed as either three motor chunks each consisting of 2- elements (2-2-2), or with two motor chunks each with 3-elements (3-3). Practice of the three DSP tasks involved either RP or BP which was followed by a 24-hr delayed test with the same motor skills without pre-structuring. As expected, the initial evaluation of pilot data revealed the anticipated CI effect. More importantly, the impact of RP was more pervasive than expected impacting initiation, concatenation, and execution. These data suggest that RP has a robust impact on the learning of sequential motor skills influencing processes beyond those related to retrieval.

Using Ecological Momentary Assessments to study the impact of social-cognitive factors on paretic hand use after stroke

Chen, Yi-An, Lewthwaite, Rebecca, Winstein, Carolee J., University of Southern California

Limited use of the paretic hand after stroke can severely constrain an individual's daily function. The presence of the non-use phenomenon, which describes the discrepancy between motor capability and daily hand use, underscores that fact that motor capability, while a necessary factor, may not be the only factor influencing paretic hand use. Recent studies demonstrate that social-cognitive factors (SCFs), which characterize an individual's psychological needs and perceptions, play an essential role in functioning after stroke. However, there continues to be a significant gap in understanding the relationship of self-efficacy, affect, and social environment to paretic hand use. Our goal is to investigate the impact of SCFs on paretic hand use in stroke survivors' daily environment, by employing an innovative application of a well-established mobile-based prompt methodology " Ecological Momentary Assessment (EMA). EMA prompts include questions capturing participants' real-time responses of SCFs and paretic hand use. In this 5-day community study, participants received 6 EMA prompts per day and were encouraged to self- initiate one anytime. On average, 12 individuals with chronic stroke (Fugl-Meyer [FM] motor score range, 21-66) responded to 81.6% of the total 30 prompts and self-triggered additional 6.9 prompts during participation. Preliminary analysis using hierarchical linear regression revealed that self-efficacy is a critical factor ($p < 0.001$) in paretic hand use in addition to motor capability. Compared between individuals who have the same FM score, those who report one point higher in self-efficacy showed a 4% greater probability to use the paretic hand in daily activities. The statistical model with both self-efficacy and FM scores explained an additional 9% of the variance in paretic hand use than the model with only FM scores ($p = 0.0006$). Further analyses with a larger sample size and objective hand use measures (e.g., accelerometers) will be conducted to provide a more robust conclusion of the association between SCFs and paretic hand use post-stroke.

Effects of time constraints and knowledge of results on mental and physical practice

Chitale, Aditi, Shea, John B., Indiana University Bloomington

Schmidt's (1975) schema theory is the primary theoretical framework for motor skill learning. Schmidt and Lee (2005) suggested two predictions of the schema theory: 1) there can be no learning in the absence of movement outcomes available through knowledge of results (KR), and 2) the learner will not be able to develop an ability to detect errors in their movement if sensory consequences are not available during practice. The present study was done to investigate response encoding and preparation before a movement occurs, and how KR effects learning during retention intervals with a time constraint. Experiment included four practice conditions which include mental practice (MP), mental practice with KR (MPKR), physical practice (PP) and physical practice with KR (PPKR). The goal for 20 acquisition trials was to learn to perform 5 keys sequence task achieving 1500ms target time. Retention was measured 10 min. after the practice trials. Diagrams depicting the tasks were not presented for Retention Test 1 (RT1) but were presented for Retention Test 2 (RT2). Thus, memory retrieval was necessary for RT1 but not for RT2. Initiation time (IT) and execution time (ET) were considered to be measures of response planning and execution processes, respectively. IT and ET measures were analyzed separately using separate 4 x 4 (Practice Condition x Trial Block) ANOVA. IT for early and late acquisition was slower for MP and MPKR compared to PP and PPKR ($p < .05$). For RT1, MPKR had slowest IT in all conditions ($p < .05$). For RT2, IT for MPKR was slower than PP and PPKR ($p < .05$). ET for PP was slower in early practice than PPKR and MPKR. There were no differences for ET measures for late practice, RT1 and RT2 for conditions. Our results show that mental practice can be affected by time constraints and KR.

External focus of attention enhances children's learning of a pirouette en dehors

Chiviacowsky, Suzete, Silva, Mariana, Lessa, Helena, Federal University of Pelotas; Wulf, Gabriele, University of Nevada, Las Vegas

Studies examining the effects of attentional focus on children's learning of form-based skills are scarce. Thus, the purpose of the present study was to investigate the influence of instructions promoting an external versus internal focus on the learning of a pirouette en dehors (from fourth position) in 10-year old novices. In addition, we sought to gain insight into learners' motivation and subjective learning experience as a function of different focus conditions. Forty children were randomly assigned to one of two groups. In the external focus (EF) group, participants were asked to focus on a spotting point on the wall in front of them, and on fixing their gaze on it for as long as possible. In the internal focus (IF) group, participants were asked to focus on the initial position of their head relative to the wall in front of them, and on keeping it in that position for as long as possible. The task goal was to spin as far as

possible, and the dependent variable was the number of degrees rotated. All participants performed 15 practice trials of a (right) pirouette. Two days later after the practice phase, participants completed retention and transfer (left pirouette) tests without attentional focus reminders. After the practice phase, participants were asked what they thought about while practicing the pirouette. In addition, they completed rating scales related to their perceived competence, effort, and importance of doing well. The EF group demonstrated superior performance relative to the IF group during practice, retention, and transfer. In addition, EF participants' responses indicated higher perceived competence and greater satisfaction with their performance, as well as greater importance of performing well. In contrast, IF participants reported greater nervousness, fear of losing balance and not doing well. Overall, the findings demonstrate that external relative to internal focus instructions enhanced children's learning of the pirouette en dehors and had positive motivational consequences.

Age stereotypes affect motor learning in older adults

Chiviacowsky, Suzete, Cardozo, Priscila, Federal University of Pelotas; Chalabaev, Aina, University Joseph Fourier - Grenoble

Motor learning research has recently increased its focus on the effects of sociocognitive and affective variables. One of these effects, considered to affect performance in several domains, is stereotype threat. Recent research with young adults has demonstrated that stereotype threat can impact not only immediate performance, but also the learning of motor skills. Studies examining this phenomenon on motor learning in other populations, however, are still lacking. The objective of the present study was to investigate whether stereotypes influence the learning of a balance task in older adults. Thirty participants, aged between 60 and 76 years, were divided into three groups. In the stereotype threat condition participants were informed that their balance performance would be compared with the performance of young adults. Participants in a stereotype lift condition were informed their balance performance would be compared with performance of participants 20 years older. In the control group, participants were informed that performance on this balance task was not influenced by age. All participants then practiced ten 60-sec-trials of a task that involved maintaining a stabilometer platform in a horizontal position for as long as possible. Twenty-four hours after the practice phase the participants performed 5 trials of a retention test, without receiving any kind of stereotype instruction. The results showed better learning for participants in the stereotype lift group than for participants in the stereotype threat group. The results corroborate previous studies with young adults and provide the first evidence that stereotypes can impact the learning of motor skills in older adults.

Does aerobic or goal-based exercise improve freezing of gait in Parkinson's disease?

Chow, Rebecca, Wilfrid Laurier University; Silveira, Carolina R. A., Roy, Eric A., University of Waterloo; Intzandt, Brittany N., Almeida, Quincy J., Wilfrid Laurier University

Freezing of gait (FOG) is commonly experienced by individuals with Parkinson's disease (PD), and is arguably the most debilitating symptom. Previous research argues that FOG may be the result of underlying impairments in various domains including cognitive or sensorimotor function. Therefore, treatment strategies aiming to improve cognitive and/or sensorimotor deficits should alleviate FOG. Interestingly, research in aerobic exercise has demonstrated improvements in cognitive function for healthy older adults. Alternatively, goal- based exercise for PD has shown improvements mainly in motor symptoms. However, the effects of these exercise interventions have not been investigated in PD with FOG. This case study examines the effects of aerobic and goal- based (PD SAFEx") exercises on the cognitive and motor symptoms of two individuals with PD who experience FOG. Participants attended 1-hour sessions 3x/week for 12 weeks. Disease severity, executive functions, and gait performance in a single- and dual-task paradigm were evaluated before and after both exercise interventions. Aerobic exercise improved executive function and gait performance on dual-task walking, while PD SAFEx" improved motor function, and performance on single-task walking. Overall, the results indicate that both types of exercise could potentially improve FOG, however through differing cognitive and motor mechanisms. These results may be an indication that both domains are involved in FOG, and therefore should warrant attention for therapeutic interventions for FOG.

Does visual-only and rhythmic-only information in speech production provide sufficient information to identify/differentiate languages?

Chuang, Kuo-Liang, Huang, Tzu-Jung, Chen, Jenn-Yeu, Liu, Yeou-Teh, National Taiwan Normal University

Communication is one of the fundamental skills in human cognitive development, and speaking is the most motoric component in language communication. The movements of the speaking articulators as well as the acoustic outcome of speaking provide specific information to convey messages. The temporal pattern of speaking is one of the acoustic characteristics that differentiate languages; for example, English is a stress-timed language whereas Mandarin Chinese is a syllable-timed language. For the movement articulators, the McGurk effect (McGurk & MacDonald, 1976) demonstrates the importance of visual information in language perception. In addition, the language experience of the speakers also plays a role in producing the many characteristics of spoken languages. The purpose of the study was to examine the perception of language characteristics based solely on the acoustic (temporal pattern) display or visual (movement) display of the speakers. 45 native Mandarin speakers viewed 48 pairs of silent video clips and listened to 48 pairs of low-passed (300 Hz) auditory clips of two sentences spoken in either English or Mandarin from either native English or native Mandarin speakers. The 48 pairs were constructed from 6 combinations of speakers/sentences with 8 repetitions for each combination. The tasks were to identify whether each pair were spoken in the same or different languages. The results show that the rhythmic acoustic display had a higher average identification rate than that of the silent visual display. However, the combination of 2 Mandarin sentences spoken by the native speaker had the highest identification rates in both acoustic and visual modes. Furthermore, the combination of 2 different languages spoken by the native English speaker also had highest identification rate in the acoustic display mode but not in the visual display mode. The findings of the study are discussed from the dynamical systems perspective where intrinsic dynamics of the motor systems play a significant role in movement production.

Dynamics of self-efficacy and performance change with balance practice in individuals with Parkinson's disease

Chung, Yu-chen, University of Southern California; Lewthwaite, Rebecca, Rancho Los Amigos National Rehabilitation Center; Winstein, Carolee J., Fisher, Beth E., University of Southern California

Reduced balance self-efficacy has been demonstrated as an independent predictor of postural control and gait deficits for individuals with Parkinson’s disease (PD), leading to the assumption that self-efficacy may be a potential target for motor performance improvement in PD. Although boosting individuals’ performance expectations has been shown to enhance motor performance and learning in non-disabled adults, this positive effect remains to be determined in PD. This is important because PD is associated with disruptions in cognitive and motivational functioning (Ravizza et al., 2012) as well as balance and movement. We investigated the relationships and dynamics of self-efficacy and movement performance in the acquisition of a novel and challenging balance task. Ten individuals with PD (64.8 years old, Hoehn and Yahr stage 2.5, MoCA range 21-30, Activity-specific Balance Confidence scale average of 86.9) practiced balancing on a stability platform. Participants received feedback after each 30-s trial in the form of time in balance (s). Individuals’ self-efficacy (SE) for 3 levels of stabilometer performance was assessed at 3 times: baseline (after task familiarization), after 14 practice trials, and immediately before a 24-hr delayed retention test. Performance at the end of practice ($p = .001$), as well as retention performance ($p = .008$), was significantly better than baseline, indicating the potential for change in balance performance in PD. Mean self-efficacy scores changed concomitantly with an average of 1.2 ($SD = 1.9$, $p = .045$) on a 10-cm VAS scale. Early and late performance reflected primacy and recency influences on post-practice SE (early: $r = .661$, $p = .038$; late: $r = .636$, $p = .048$). These results suggest that individuals with PD with mild disease severity experience performance and self-efficacy changes with practice in a manner consistent with that of non-disabled older adults. Therefore, confidence-building components may be potentially useful in balance and movement skill interventions for this population.

How anxiety and incremental secondary task demands impact processing efficiency, visual search, and gait kinematics in older adults

Cocks, Adam J., Young, William R., Ellmers, Toby J., Brunel University London; Jackson, Robin C., Loughborough University; Williams, A. Mark., Brunel University London

We examined the impact of anxiety, in combination with incremental cognitive dual-task demands, on visual attentional control, processing efficiency, and gait during adaptive walking in older adults. Moreover, we tested the application of Attentional Control Theory (ACT; Eysenck et al., 2007) to the domain of fall-risk in older adults. High- (n = 10) and low-trait anxious older adults (n = 10) traversed along a novel adaptive walking path, which was reminiscent of navigating along paving stones within a designated pattern. The secondary task involved increasing difficulties of serial subtraction. Subtraction was conducted from a designated number in twos (low-difficulty), threes (medium-difficulty), and sevens (high-difficulty). Dual-task performance was assessed using mental effort ratings, proportion of correct responses to cognitive tasks, gaze behaviour, stepping accuracy, and gait velocity. Higher levels of cognitive demand produced incrementally larger ratings of mental effort, increases in absolute stepping error, and increases in the number of task-irrelevant fixations. Dual-task costs on cognitive performance were found to be greater in low- and high-difficulty conditions when compared to medium-difficulty. Greater anxiety coupled with increasing secondary task demands caused a reduction in visual planning behaviour and a decrease in mean gait velocity when under higher cognitive loads. Lower levels of anxiety resulted in a greater number of task-irrelevant fixations. Higher anxiety was shown to result in higher and more variable decelerations. Findings provide partial support for the applications of ACT to the study of gait and posture within older adults. Further application and analysis of theoretical frameworks within gait research is encouraged.

Effects of attentional focus instructions on standing long jump performance in early adolescents

Coker, Cheryl A., Plymouth State University

Research over the past 15 years has consistently demonstrated learning and performance advantages for the adoption of an external versus internal focus. Few studies, however, have examined attentional focus effects with early adolescents. Given the developmental differences between pre-teens and adults, the question remains whether these same findings are generalizable to a youth population. Using a counterbalanced, within participant design, 26 seventh grade student volunteers from a local middle school physical education program (X age =12.7 years) performed two standing long jumps for maximum displacement in each of four experimental conditions: (1) Control - no attentional focusing cues, (2) Leg - focused on extending their knees as rapidly as possible, (3) Arm - prompted to focus on swinging their arms forward as rapidly as possible and (4) External - focused on jumping as close as possible to a cone placed 3m directly in front of them. The adoption of an external focus resulted in significantly farther jumping distances. Take off angles were also significantly lower when directed to focus externally (36.9o) versus internally to both the action of the legs (40.2o) and arms (38.6o). In addition, compared with the Leg focus, both the Control and Arm conditions lead to significantly greater jumping distances but only the control condition yielded a difference in takeoff angle, one which was significantly lower. While these results are consistent with the literature comparing external and internal attentional foci, differences were noted when compared with Coker (2015) whose participants were college students. In that study, a significant difference in takeoff angle was found between the Arm and Leg focus but not between the Arm and External conditions. Cueing early adolescents to focus on arm action did not constrain the movement in the same manner. Additional studies are needed to examine these differential effects.

Dynamic pattern changes of the hip and ankle angles after a trip-training session

Cone, Brian L., University of North Carolina at Greensboro; Babik, Iryna, University of Delaware; Wittstein, Matthew W., Elon University; Michel, George, University of North Carolina at Greensboro; Kiefer, Adam W., University of Cinncinati; Rhea, Christopher K., University of North Carolina at Greensboro

Researchers have begun to incorporate trip-training into fall-prevention studies. These studies have shown there is a moderate reduction in trip rates after trip- training, but the mechanism for this more adaptive behavior is unknown. This study measured how dynamic patterns of the hip and ankle change over time during a trip-training session, which could lead to a stronger understanding of how more adaptive gait emerges and potentially a refinement of trip-training programs. This project utilized recurrence quantification analysis (RQA) to examine how dynamic patterns of hip and ankle angles (two variables commonly modified to maintain balance) change from the beginning to end of a trip-training session. Young, healthy adults (N=26, 23.1"3.7 yrs) completed a 10-minute trip-training session on an ActiveStep treadmill. A trip was induced every 100"20 steps via a sudden belt deceleration followed by a rapid belt acceleration to the pre-trip speed, resulting in 10 trips per participant. Full-body kinematic data was

captured at a sampling rate of 200 Hz. RQA determinism (DET, a measure of repeating patterns in the signal) and entropy (ENT, a measure of signal complexity) were quantified for the hip and ankle angles from the 10 strides before trip 1 and trip 10. Recovery of gait performance was quantified by the duration of strides required to return to pre-trip behavior [recovery duration (Rdur)]. Rdur showed a significant decline between trip 1 (M=6.33, SD=2.34) and trip 10 (M=3.85, SD=1.49); t(25)=5.145, p<.001, indicating a quicker recovery. Hip angle showed a significant decline in DET between pre-trip 1 (M=98.80, SD=0.40) and pre-trip 10 (M=98.71, SD=0.44); t(25)=2.45, p=.02, and a significant decline in ENT between pre-trip 1 (M=5.14, SD=0.30) and pre-trip 10 (M=5.08, SD=0.30); t(25)=2.25, p=.03. No significant differences were observed in the ankle angle. These results suggest that the trip-training session led to a reorganization of the hip angle (a combination of the trunk and thigh segments), allowing a more flexible (i.e., less rigid) behavior to emerge.

Expecting to teach enhances learning: Evidence from a motor learning paradigm

Daou, Marcos, Buchanan, Taylor, Lindsey, Kyle, Lohse, Keith R., Miller, Matthew W., Auburn University

There is some evidence that people learn academic (declarative) information better when studying with the expectation of having to teach, but this has not been demonstrated for perceptual-motor skills, which also rely on declarative information but more heavily on procedural knowledge. To address this possibility, participants studied golf putting instructions and practiced putting with the expectation of having to teach another participant how to putt or the expectation of being tested on their putting. One day later, learning was assessed by testing all participants on their golf putting. Results revealed that expecting to teach directly enhanced learning (even after controlling for the quantity of studying and practicing). Therefore, the present study is the first to reveal that expecting to teach enhances motor learning and, taken together with similar studies focusing on declarative information, the present work suggests expecting to teach yields a general learning benefit to different types of skills.

Characterizing neuromuscular control processes that underlie postural stabilization via a forced harmonic oscillator model: A comparison of athletes returning to play after anterior cruciate ligament reconstruction and healthy athletes--Using a novel postural assessment device to detect balance deficits following mild traumatic brain injury

Dicesare, Christopher, Kiefer, Adam W., Cincinnati Children's Hospital Medical Center; Baxter, Josh R., Univeristy of Pennsylvania; Sugimoto, Dai, The Micheli Center for Sports Injury Prevention; Ganley, Theodore J., Children's Hospital of Philadelphia; Myer, Gregory D., Cincinnati Children's Hospital Medical Center

Jumping and landing dynamics have been modeled by forced harmonic oscillators to characterize movement patterns and strategies. Athletes returning to play following anterior cruciate ligament reconstruction (ACLR) demonstrate impaired neuromuscular control that disrupts force absorption and dynamic stabilization strategies during landing maneuvers. This study compared the neuromuscular control processes that underlie postural stabilization in healthy and ACLR athletes during a single-leg landing task. A total of 103 athletes (28 ACLR, 75 healthy) performed a single-leg landing from a 31-cm box onto a force platform and held the landing for 3 seconds. Involved ACLR limb was compared to the left leg of matched healthy athletes performing the same task. Ground reaction force (GRF) landing profiles were fit using a passive, one-body, one-dimensional forced harmonic oscillator model that considered the point mass of the entire body. The model was a medium order, non-stiff ordinary differential equation: stiffness and damping parameters were modified for best fit. The residual sum of squares was used to fit the model to the transient period of oscillatory motion during landing, defined as the period from either the active GRF peak to 500 ms or the first local maximum, whichever occurred first (Mean R2=0.96). The ACLR group exhibited 22.1% less mathematical stiffness compared to the healthy group, t(81.8) = 2.33, p=.02 (ACLR group: M=32.4"2.69; Healthy group: M=41.6"2.84), while no differences in the damping term or the coefficient of resistance outcome, indicative of mathematical stabilization, were observed. Although the mathematical time to stabilization did not vary between the two groups, the forced harmonic oscillator model characterized important GRF differences relative to the neuromuscular control processes that underlie single-leg stabilization in athletes returning to play after ACLR compared to healthy athletes.—*NFL Charities*

Distracted driving behaviors: How do we change them?

Didier, Jennifer J., Glave, A Page P., Gregg, Ashley, Kaya, Omer, Maldonado, Abel, Sam Houston State University

Research has shown the dangers of distracted driving (Charlton, 2009; Hosking, et al., 2009) and our limitations in multitasking (Hyman, et al., 2010; Thornton et al., 2014), but how do we change our behaviors? The use of cell phones as a multitasking tool has increased dramatically. While individuals are aware of the risk, they underestimate their performance decrements (Finley, Benjamin, & McCarley, 2014). Nemme & White (2010) also found drivers are more likely to text and drive (T&D) if their peers accept this behavior. Cell phones, initially used for emergencies, are now used for everything from checking time, to mapping, communication, and gaming. Participants (n=51, M = 21.2 yrs) who both drive and own a smart phone were placed into one of three intervention groups. All completed a general survey of questions related to T&D experience, current cell phone use and driving status. They then performed a RT/multitasking activity (RTO, N=16), watched a video on T&D accidents (WVO, N=18), or both (RTV, N=17). They then completed another survey questioning how often they use their phone while driving, what activities they perform, and how likely they are to use their cell phone in the future. A one-way MANOVA testing the 3 behavior responses for each condition found no significant differences among groups for their current distracted driving behaviors ($F = 0.44$, $p>.01$), but found significant differences among groups for their future distracted driving (FDD) behavior ($F = 7.17$, $p<.01$) and the amount of predicted change (PC) in their behaviors ($F=5.99$, $p<.01$). These results indicate the groups were similar, but the interventions had different effects on their behaviors. Post-hoc comparisons indicated the differences were between the RTO & WVO and RTO & RTV for FDD, and between RTO & WVO for the PC scores, indicating the video had the greatest impact. While these results are encouraging in reducing distracted driving, and similar to previous data (Didier, 2014), it was hoped the physical act of performing the multi-tasking behaviors would have had a greater effect.

Focus of attention in NCAA division 1 collegiate athletes: A qualitative investigation

Diekfuss, Jed A., University of North Carolina at Greensboro; Raisbeck, Louisa D., The University of North Carolina at Greensboro

The benefits of using an external focus of attention compared to an internal focus of attention are consistently documented (Wulf, 2013). While the motor performance and learning benefits of an external focus have been well established in laboratory settings, there is minimal empirical data detailing the focus of attention NCAA division 1 student-athletes use in collegiate sports. This study qualitatively describes the focus of attention NCAA division 1 student-athletes use during practice and competition (n = 9; 5 male golfers & 4 female soccer players). Participants were observed for 10 hours total in their natural practice setting, participated in 5 semi-structured interviews, and 3 focus groups. Data was transcribed, coded, and used to develop common themes based on the attentional focus literature. Two common themes emerged: situational focus of attention and reactivity focus of attention. We describe situational focus of attention as the unique focus of attention student-athletes take within a situation and context. For example, interview data revealed that male golf performers use an internal focus of attention when performing close "pitch" shots, but an external focus of attention when driving the ball from a tee. On the other hand, we describe reactivity focus of attention as the focus of attention performers adapt as a result of prior mood or performance. For example, our focus group revealed that a female soccer player's focus of attention is internal following poor performance, but shifts towards an external focus following superior performance. This is unique information describing how NCAA division 1 student-athletes' focus of attention can vary depending on their mood or present situation. Our research adds to the motor learning literature by presenting two alternate yet complementary forms of attentional focus.

The effects of attentional focus on brain activation when performing a leg flexion and extension task

Diekfuss, Jed A., The University of North Carolina at Greensboro; Grooms, Dustin R., Ohio University; Schmitz, Randy J., The University of North Carolina at Greensboro; Kraft, Robert A., Wake Forest University; Raisbeck, Louisa D., The University of North Carolina at Greensboro

The beneficial effects of using an external focus of attention (FOA) relative to an internal FOA for motor performance and learning are well documented (Wulf, 2013). However, the neural mechanisms underlying "why" are mostly unknown (Wulf, 2013). Assessing brain function using functional magnetic resonance imaging (fMRI) provides a means to fill this gap. The purpose of this study was to investigate brain activation differences when participants performed a gross motor movement using either an internal and external FOA. Ten healthy subjects (5 F, 5 M; 25.2 " 4.64 yrs.) completed a series of unilateral 45" knee extension/flexion movements at a velocity of 1.2

Hz laying supine in a MRI scanner. Participants were instructed to “squeeze their quadriceps” during the internal FOA and to "focus on a target" positioned 3 inches above their tibia during the external FOA. Trial order was randomized and functional imaging data was acquired using a 3Tesla scanner. A second level fixed-effects paired samples t-test contrasted brain activation in the external FOA with the internal FOA using a significance level set a priori at $p < .05$; gaussian random field cluster corrected and z threshold set at $z > 2.3$. Results revealed significantly greater brain activation in the precuneous cortex ($z = 5.99$, $p < .001$), occipital pole ($z = 5.49$, $p < .001$), and frontal pole cortex ($z = 4.88$, $p < .001$) during the external FOA compared to the internal FOA. The precuneous cortex is involved in the visuospatial network for motor control, the occipital pole is associated with vision and information processing, and the frontal pole cortex has been linked to working memory, indicating that an external FOA activates attention, sensory, and visual brain regions to a greater degree than an internal FOA. This neurophysiologic data suggests a more dispersive cortical network for external FOA during motor tasks. It is possible that this increases the salient aspects of establishing motor memories, providing a partial explanation for the improvements in motor performance when using an external FOA.

Fractal dynamics and gait adaptability during asymmetrical walking

Ducharme, Scott W., University of Massachusetts, Amherst; Liddy, Joshua J., Haddad, Jeffrey M., Purdue University; Busa, Michael A., University of Massachusetts, Amherst; Claxton, Laura J., Purdue University; Van Emmerik, Richard EA., University of Massachusetts, Amherst

The ability to adapt locomotor patterns is necessary to successfully navigate through environments of various terrains and obstacles. The variability of timing from stride to stride is not random, but rather patterned and complex. Specifically, fluctuations that occur across shorter timescales (e.g. 5-10 strides) are statistically correlated to fluctuations that occur across longer timescales (e.g. 50-100 strides) in young, healthy adults. These correlations, known as fractal dynamics, are thought to reflect adaptable gait, although this has not been tested empirically. The purpose of this study is to investigate the relationship between the fractal dynamics and adaptability of gait using a novel split-belt treadmill walking task that requires participants to adapt gait symmetry. Method: Eleven young, healthy adults (6M, 5F) walked on a split-belt treadmill at preferred walking speed (PWS), half PWS, and a hybrid 2:1 split-belt condition in which the right belt traveled at PWS and the left belt at half PWS. All trials were 15 minutes long. Bilateral lower body kinematics were collected at 120 Hz. The first 500 stride times of each leg were submitted to detrended fluctuation analysis to determine the fractal scaling exponent, or strength of fractality. Lag time to maximal negative correlation of the hip angles was performed for each stride to determine deviation from intended phasing (anti-phase) as a measure of gait symmetry. Results: The fractal scaling index and mean magnitude of phase deviation yielded a quadratic relationship in the split-belt condition, whereby the highest and lowest fractal values resulted in the largest phase deviation ($r2 = .97$ and .91 for the left and right leg, respectively). Discussion: These results indicate that, during asymmetric walking, extreme fractal scaling exponents (very high or low) correspond with suboptimal adaption to perturbed gait. Thus, the nature of fractal dynamics may provide an explanation for observed reductions in locomotor adaptability during perturbed gait.

Observation of postural imbalance does not induce postural reactions: A replication study of a motor contagion effect

Eils, Eric, Institute of Sport and Exercise Science; Richter, Sascha, Kuhlmann, Hendrik, Seitz, Alexander, Luiking, Ole, Mehren, Aylin, de Lussanet, Marc, Zentgraf, Karen, Institute of Sport and Exercise Science, University of Muenster

A motor contagion effect (MCE) resulting in increased body sway when observing a point-light display (PLD) of a model in postural imbalance in comparison to a non-biological stimulus (NBS) was recently postulated (Tia et al.,2011). The aims of the present experiments were first, to constructively replicate the MCE (Open Science Collab., 2015) and second, to elucidate the conditions that lead to an MCE. All replication studies (RS) were kept similar to the original study (OS), in which subjects (N=18) stood in front of a screen displaying different PLD stimuli (a gymnast balancing on a rope (biological motion-BM), the same PLD inverted, and a control stimulus-CS). Postural responses were measured using a force plate. In our five RS, we subsequently varied single specific aspects and used larger sample sizes (N=32,33,28,26,20). Replication study 1 used different PLD stimuli than the OS. RS2 changed the non-biological stimuli (from inverted to scrambled). RS3 changed both the observed and the observer’s

task from double-leg to single-leg stance. RS4 and RS5 changed the viewing angle of observers from 50" to 3" and 16", respectively. In all studies, a rmANOVA for the within-factor stimuli (depend.var: sway excursion) was performed. An MCE is obtained when the BS is significantly increased compared to the NBS and the CS. Power was calculated a-posteriori for all studies. Tia found a significant MCE for anterior-posterior (ap) sway excursion. We were not able to replicate these results. No MCE could be observed for any RS in both ml or ap direction. Statistical power of RP was higher than estimated power in the OS (.59 vs. .86,.87,.81,.78 and.62). Results indicate that the observed MCE in the OS is of weak evidence. Power calculation of our RS revealed sufficient power to detect postulated effects. Although there seems to be evidence that humans are prone to copy the action of others (Heyes, C., 2011), it might not be as generalizable as previously suggested. Complementary inhibition processes preventing loss of balance might play a crucial role, masking MCE.

The psychological factors mediating post-intervention improvements in older-adult functional balance

Ellmers, Toby J., Brunel University London; Paraskevopoulos, Ioannis, University of Greenwich; McIntyre, Anne, Williams, A. Mark., Young, William R., Brunel University London

Recent technological developments have led to "exergames" (exercise + videogames) becoming a common platform for balance-based exercise interventions in older adults. However, these interventions often use commercially available exergames not designed to train areas of balance that decline with age. Furthermore, whilst preliminary research indicates the positive impact exergame interventions can have on balance confidence (Young et al., 2012), little is known about how enhanced confidence may mediate post-intervention improvements in balance. Therefore, the aims of the study were to investigate (1) whether playing a custom-designed exergame could improve functional balance in older adults, and (2) the psychological mechanisms underpinning any observed improvements in balance. Twenty-six older adults completed a 4-week balance intervention, in which they trained anterior-posterior balance using a custom-designed exergame. Measures of functional balance were recorded throughout the intervention. Structured focus groups were used to assess psychological functioning, with these analysed through inductive thematic analysis. Gameplay was followed by a 2-week no-gameplay retention period. Results showed significant improvements in balance performance. Furthermore, these improvements were maintained following a 2-week no-gameplay retention period. Focus group data revealed that these improvements may be explained by a change in perceived action capabilities, with participants stating that they were more "aware" of their balance abilities. Previous research has demonstrated the discrepancy between older adults' perceived postural capabilities and their actual postural performance levels (Lafargue et al., 2013). We propose that post-intervention improvements in functional balance may have been the result of a recalibration of the participants' perception of their balance capabilities. Our findings support the application of custom-designed exergames in a clinical setting and highlight the importance of psychological factors in explaining any observed improvements.

Relationships between jump, sprint and agility performance in different team sports

Fleddermann, Marie-Therese, Heppe, Holger, Eils, Eric, Zentgraf, Karen, University of Munster

Many of team and field sports are characterized by high intensity speed actions, which would appear fundamental to success. Speed actions can be classified in different categories such as jumping performance, the ability to change direction and sprinting performance. Many studies have been conducted with the aim to detect relationships of speed actions parameters with contradictory findings (Little & Williams, 2005). Cronin and Hansen (2005) found weak correlations between jumping and sprint performance; Wilsloff et al. (2004) have shown strong correlation in elite soccer players. Most studies have included only one gender and no different types of team sport. Therefore, the aim of the study was to investigate the relationship between 5m-sprint, agility and vertical jump performance in different team sports and gender. 76 (34 females) well-trained, competitive participants on national and regional top level between 15 and 32 years from different team sports (handball n=21, volleyball n=30, beachvolleyball n=9, soccer n=16) performed a 5m- sprint test (5m), countermovement Jump (CMJ), Drop Jump (DJ) and the Handball agility specific test (HAST). The results show relations between jump height measures and HAST (CMJ: r = 0.44; DJ: r = 0.54) and 5m performance (CMJ: r = 0.53; DJ: r = 0.54). Strongest correlation was detected (r = 0.76) between 5m and HAST. However, there is no strong relation between DJ contact time and all other parameters. In a factor

analysis of the data, we identified three factors explaining substantial amounts of variance: one factor relating mainly to 5m and HAST, one factor relating to CMJ and DJ, and a third factor relating exclusively to contact time in DJ. Investigation of speed actions in elite athletes showed that observed parameters are basically reflected by three underlying latent variables independent from the type of team sports. Pattern was similar in both gender. Confirmatory factor analysis must substantiate these results in future research.

Investigating the influence of dominance on joint position sense
Forsyth, Amanda N., Bryden, Pamela J., Wilfrid Laurier University

Limb dominance has been studied widely by researchers, however much ambiguity exists as to the influence it has on joint position sense. The two most common measures of position sense require matching the joint to a target angle in either the contralateral or ipsilateral joint. Furthermore, each measure can be collected through either passive or active positioning. Early research reported no significant difference between the left and right shoulders and knees of healthy young adults in terms of joint position sense (Lephart et al., 1994; Voight et al., 1996; Femery et al., 2000). However, more recently Goble and colleagues (2005, 2006, 2009, 2010) have found repeatedly that the non-dominant elbow has more accurate position sense compared to the dominant elbow, supporting the Dynamic Dominance theory of handedness. Some possible explanations for the conflicting results include inconsistent measures of position sense, repositioning methods, and equipment, all of which vary in the experiments listed above. Work by Goble et al. (2010) and Gay et al. (2010) has shown that the superior way to measure position sense is through the use of active ipsilateral repositioning. Therefore, the current study sought to explore the influence of dominance on position sense using active ipsilateral repositioning with consistent equipment across multiple joints in the body. A Vernier goniometer was used to test joint position sense in the elbows, knees, and ankles of healthy young adults. Preliminary results revealed a significant interaction between joint and side (p=0.043) indicating that joint position sense differed in accuracy between the right and left side of the body as a function of side. These results support the more recent research by Goble and colleagues described above, thus suggesting that dominance may influence joint position sense. Further research is being conducted to examine the wrist joint in order to make comparisons between the upper and lower limbs.—*NSERC*

Dosage effect on retention of a fractal gait pattern using a fractal visual metronome
Frame, Logan J., Raisbeck, Louisa D., Etnier, Jennifer L., Rhea, Chris K., University of North Carolina in Greensboro

Healthy adults are known to exhibit fractal patterns within their gait, indicating an ability to appropriately respond to perturbations is present. It is proposed that the age-related increase in falls-risk is directly associated with a weakening in the fractal gait patterns in older adults. Therefore, developing methods to strengthen fractal patterns may help enhance gait adaptability. Prior studies have shown strengthening of fractal gait patterns when participants synchronize to a fractal visual metronome. More importantly the newly strengthened gait patterns are retained after only one session of training. However, the retained fractal gait patterns were weaker than the prescribed pattern in the visual metronome. It is unknown whether there is a dosage effect with increased training would result in stronger fractal gait patterns. Young healthy adults (n = 17, 22.8"2.2 yrs) were instructed to synchronize to a fractal visual metronome during 10 min of treadmill walking for seven consecutive days. The visual metronome consisted of a left and right footprint displayed on an iPad screen, which indicated the desired timing of heel-strike for each limb. The timing structure was fractal, as quantified by detrended fluctuation analysis alpha (DFA α of the stimulus was 0.98). Stride time was recorded during the walk and submitted to DFA to determine the α metric for each day in order to quantify the strength of the fractal gait pattern. The main effect of day approached significance for stride time, $F(6,96) = 1.96$, $p = .079$, indicating a trend toward strengthening DFA α, which steadily increased across the seven days of training (mean ‘sD for days 1-7 listed in order: 79".09, .82".12, .83".12, .83.12, .86".11, .86".11, 87".13). To our knowledge, this is the first study to examine the strengthening of fractal gait patterns over multiple training sessions. These data suggests there is a dosage effect with increased training to strengthen fractal gait patterns. The retention of these newly strengthened patterns will be examined in future research.

Anticipatory judgments in tennis: The effect of available graphical information
Fukuhara, Kazunobu, Ogata, Takahiro, Higuchi, Takahiro, Tokyo Metropolitan University

Recent studies have reported that expert tennis players are more likely to use a "global" perceptual strategy than a "local" one when anticipating stroke directions in tennis (e.g., Huys et al., 2009; Williams et al., 2009). Global perceptual strategy refers to the pick-up of kinematic information on the whole body rather than on a specific location such as the racket-arm regions. In order to obtain more detailed information about the use of a perceptual strategy by expert tennis players, we used a novel methodological approach using computer graphics (CG) images in which the entire body was presented by a combination of point- light (i.e., poor graphical information) and polygon (i.e., rich graphical information). Fifteen expert tennis players and 15 novice players attempted to anticipate stroke directions (left or right directions) by observing CG tennis strokes. The results showed that expert players were superior in anticipating stroke judgments. Moreover, expert players' anticipatory performance was the highest when central body regions (i.e., trunk-hip, head-shoulder, and left arm) were presented with rich graphical information. These results suggest that richness of the kinematic graphical information on central body regions is a key factor that affects expert players' anticipatory performance.

A comparison of strength profiles in children screened using the Movement Assessment Battery for Children-2.

Furzer, Bonnie, University of Western Australia; Wright, Kemi, Thornton, Ashleigh, University of Western Australia

Studies have shown that children with Developmental Coordination Disorder (DCD) produce substantially lower maximum force and are less powerful in comparison with their Typically Developing (TD) peers. The evidence from this research gives support to the theory that muscular strength and power may be underlying deficits that contribute to the movement difficulties found in children with DCD. Sixty four children (mean age 7.91"1.5yrs) participated in the study. Movement proficiency (MP) was assessed via the Movement Assessment Battery for Children-2 (MABC-2); 41 children were classified as TD according to MABC-2 scores, with 10 classified as having "possible difficulties" and 13 probable DCD (pDCD). Children completed 5-repetition maximum (5RM) leg press, the Resistance Training Skills Battery for Children (RTSBc) and peak torque of the knee flexors and extensors were assessed isometrically and isokinetically using a Biodex dynamometer. Analyses of variance between groups revealed RTSBc scores to be significantly different ($F(2,61)=13.179$, $p<.001$), with TD children scoring significantly higher than those with possible difficulties ($p= .021$) and pDCD ($p <.001$). 5RM scores were also significantly different between groups ($F(2,61)=5.618$, $p=.006$), but only between TD children and the pDCD group. No differences were found between groups for isometric or isokinetic measures of strength. This research demonstrates that strength profiles of children screened using the MABC-2 change along with the complexity of the task. No differences were observed in strength between TD children and those with possible or pDCD for limb-isolated tasks such as the Biodex, however tasks requiring more motor planning and control, such as 5RM and RTSBc elicited a significant difference. pDCD children often performed poorly compared to TD children or even children with probable difficulties. These findings suggest that interventions targeting children with motor impairments should target functional strength and coordination, rather than isometric or isolated strengthening exercises.—*UWA Paediatric Exercise Health Research Group*

Linking brain and behavior in the Tower of Hanoi task: Research and applications to atypical populations

Getchell, Nancy, University of Delaware; Liang, Ling-Yin, University of Evansville; Shewokis, Patricia A., Drexel University

Certain learning and developmental disabilities, while not considered to be movement disorders, are frequently accompanied by issues in motor control. In Autism Spectrum Disorder (ASD), researchers have linked some characteristics such as social interaction difficulties to atypical prefrontal cortex (PFC) activity. If dyspraxia stems from atypical PFC activity, this suggests motor planning and executive function may be central to movement dysfunction in this and other populations. Alternatively, issues may occur due to an inability to execute (rather than formulate) a movement plan. Understanding the relationship between PFC activity and motor dysfunction in ASD is critical to creating effective, efficient interventions. We attempt to control motor and/or cognitive difficulty in a Tower of Hanoi, an executive function task, to compare PFC activity among groups and conditions. The game consists of three vertical pegs and a number of disks graduated in size with the largest disk at the bottom. The object of the game is to move all the disks from a start state to a goal state while following two rules: 1) only one disk may be moved at a time, and 2) a disk may never be placed on top of a disk smaller than itself. Tower of Hanoi

completion requires complex executive functions of inhibition, working memory, and planning. We use functional near infrared spectroscopy (fNIRS) to examine hemodynamic responses associated with neural activity in the PFC during task performance. In experiment#1, PFC activity is assessed when 17 healthy adult participants performed either the Tower of Hanoi or a simple tapping task on an iPad. PFC activation differences were found between the tasks. Experiment#2 in compared 10 typically developing children to 6 children with ASD on the same tasks. Differences were found only for the behavioral measures. Discussion focuses on the implications of the findings regarding motor planning, executive function and movement function in adults, typically developing children and children with ASD.

The effects of rhythmic auditory cueing and changing task difficulty in a goal-directed reach task
Glazebrook, Cheryl M., Ladwig, Jacqueline C., University of Manitoba

During reaching movements the integration of visual and auditory information is modulated online in relation to limb velocity. Presently it is unknown when during a goal-directed movement audiovisual information is integrated in relation to relative task difficulty. The present study considers the influence of an auditory stimulus in a goal-directed reach task on the planning and execution phases of a reach with varying relative task difficulty (dominant/non-dominant hand). Three conditions were presented: No Sound, Sound:Before, Sound:During. In the sound conditions the auditory stimulus was a series of three tones presented over a 6s duration. Participants (N=7; 18-40yrs) were instructed to reach from a home switch at the participant's midline to one of two targets placed 40cm away, using a natural and accurate reach. Movements were measured using the Optotrak 3-D Investigator (250Hz). Infrared emitting diodes (IREDs) were placed on participants' right and left arms on the tip of the index finger. Participants performed a total of 40 trials (20/hand), in each of the three conditions, for a total of 120 trials. Dependent measures of reaction time (RT), movement time (MT), variable error (VE), and submovements were analyzed using a 3 Condition x 2 Hand repeated measures ANOVA ($p<.05$). Analyses demonstrated no significant differences for VE and significantly longer MTs for Sound:During, regardless of hand. RT was longer in the Sound:During condition, using the preferred hand. In the analysis of spatial variability the location of the limb (position at peak acceleration, velocity, deceleration, and endpoint) was added. A significant interaction was found between hand, condition, and location. Further analyses using Tukey's HSD showed that in the Sound:During condition with the preferred hand that significantly more online control was present from peak deceleration to movement end. The presence of a sound during a movement increased early spatial variability, with evidence of the dominant hand engaging in more online control relative to the non-dominant.—*NSERC; Research Manitoba*

Relationship between recognition of gymnastic skills and the excitability of the primary motor cortex
Goto, Kana, Mukogawa Woman's University; Nakamoto, Hiroki, National Institute of Fitness and Sports in Kanoya; Mori, Shiro, University-National Institute of Fitness and Sports in Kanoya

The aim was to investigate relationship between recognition accuracy of gymnastic skills and the excitability of the primary motor cortex under limited visual information. Study participants were 10 expert gymnasts and 10 novices. The study task included observation of gymnastic movement that displayed by point-light on a monitor. Point-light numbers were 10 points, 4 points, 2 points. Four gymnastic movement (handspring, flic-flac, handstand forward roll, and round off) were involved. Magnetic stimulation was applied to the primary motor cortex area of the participants by using a transcranial magnetic stimulator during observation of point-light displays. The participants were required to answer the perceived gymnastic movement by selecting from among alternatives. The motor evoked potential (MEP) and recognition accuracy of gymnastic movements were measured. Regarding MEP, an analysis of variance (ANOVA) for three factors (proficiency, point-light conditions, and gymnastic movement) showed significant main effects for proficiency and techniques. For proficiency, the results of a multiple comparison showed that expert gymnasts had significantly higher MEP than novices ($p < .05$). The results of a multiple comparison for techniques showed that handstand-forward roll had significantly higher MEP than flic-flac ($p < .01$). Further, there was significant interaction of point-light conditions with proficiency. A simple main effect showed that with 2 (light) points, expert gymnasts had significantly higher MEP than novices, and that for expert gymnasts, 2 points evoked significantly higher MEP than 4 points ($p < .05$). These results indicate that observation of easier techniques that previously practiced excited their motor cortex, while no such motor cortex excitement occurred for the

techniques that they had not practiced. Further, expert gymnasts may recruit the motor system in order to perceive accurately the gymnastic movement when they need to image the movement from limited information.

The impact of mental and physical practice on the motor retention of a dance sequence in dancers and non-dancers

Haibach, Pamela, SUNY Brockport; Ballaro, Marisa, College at Brockport

The present study examined the effectiveness of physical and mental practice when learning a novel dance sequence in experienced dancers, D, and non-dancers, ND. Participants were randomly placed into one of four practice conditions, PP, Physical Practice, MP, Mental Practice, BP, Both Mental and Physical Practice, and NP, No Practice groups. To examine the quality of movement, 3D motion tracking assessed the movement on 11 positions using the Ariel Performance Analysis System. In addition, the quality of the movement was assessed identifying specific components of dance elements related to performance. Results of the motion analyses revealed that PP aided in the creation of more accurate joint angles (elbow). However, there was no significant differences between D and ND during the post test for elbow angle ($p > 0.05$). In addition, ND produced significantly more angle of hip flexion (unsuccessful) than D ($p < 0.05$). In regard to practice conditions, the only group that improved in all quantitative areas assessed was the BP group, with the NP group performing worse in all parts of the movements. The most significant results were found inside of the qualitative assessment. All dancers scored a three during the pretest and when exposed to either physical, mental, or both types of practice, the accurate movement was maintained. The NP was the only group to decrease their performance score. In terms of timing, all dancers improved, with PP, MP, and BP groups improving to perfect accuracy. In regards to eye tracking the dancers improved with practice, but not significantly. ND performed much more accurately in terms of eye tracking and qualitative analysis, but never reached the ability of the dancers through practice in terms of body part initiation. In conclusion, dance experience was the most important factor in performance. The examination of practice conditions confirmed that practice was necessary to maintain or improve performance and that the combination of mental and physical practice led to the highest performances.

Administering testosterone reduces distractibility for visual selective attention in healthy human males

Hansen, Steve, Nipissing University; Stoet, Gijsbert, University of Glasgow; Archer, John, Judge, Jeannie, University of Central Lancashire; Carre, Justin M., Nipissing University

The current study assessed the impact of exogenously administered testosterone (T) on visual selective attention. Fourteen healthy males completed a visual reaction time task that consisted of a go or no-go manual response to a central stimulus that was combined with a compatible or incompatible flanking stimulus (see Stoet, 2010). The flanking stimulus appeared before the central stimulus in one of eight surrounding squares on a 3 x 3 grid. Participants were to respond to a green central "go" stimulus and withhold their response to a red central "no-go" stimulus, irrespective of the compatibility of the flanker. In a double-blinded repeated measures placebo-controlled design, participants completed the task on two separate days that were separated by two weeks. Participants received either a placebo gel or a dose of T before each testing day. Compared to baseline and the placebo conditions, total-T levels increased significantly within 60 min of T-administration, and remained at elevated levels 120 min post-administration, $F(2, 26) = 13.16$, $p<0.001$. Reaction time was shorter in the compatible condition compared to the incompatible or neutral conditions, $F(2, 26) = 20.99$, $p< 0.001$. There was no main effect ($p=0.641$) or interaction ($p=0.904$) involving hormone condition for reaction time. However, after T- administration, males committed significantly less errors within the condition where an incompatible flanker was combined with a no-go response, $F(2, 26) = 3.44$, $p<0.047$. Specifically, with T-administration, participants correctly withheld their responses more often when a no-go stimulus was presented and the flanker was consistent with a go response. The results indicate that participants are less distracted by irrelevant flanker stimuli with higher T levels. They also denote that sex hormones that influence the dopaminergic system have a role in the functioning of human visual selective attention processes.—*NSERC; NOHFC*

Effects of pattern running vs. reactive initiation training on badminton on-court agility
Hart, Thomas P., Zhu, Qin A., University of Wyoming

This field study examines the effects of pattern running and reaction initiation training on a simulated badminton agility task. Novice College-aged students (n=5) were pre-tested in a badminton task, in which they had to use a racket to intercept a shuttlecock randomly thrown to a corner of the court without seeing the thrower (coach). Correct initiation time (CIT) and movement time (MT) in each trial was calculated from the videotaped performance for each participant. Subsequently, participants were randomly assigned to a training group. One group (n=2) trained with the pattern running task (PRT), which involved sprinting toward the corners of a badminton court in a predetermined path. The other group (n=3) trained with the reactive initiation task (RIT), which involved reacting to a randomly displayed directional signal using the racquet foot. Both groups received 4 bouts of training per day for 5 days, and showed noticeable improvements. They were post-tested with the same badminton agility task on court. The normalized changes of CIT and MT, as well as the normalized changes of their respective contribution to the total response time from pre- and post- test, were calculated for each participant. The independent group T-test showed a significant difference ($p < .05$) between groups for the change of MT ($p=.038$) and the change of contribution of CIT to total response time ($p=.004$). In summary, PRT training seems to be effective to improve MT and contribution of CIT to total response time on badminton on-court agility.

Effects of motor imagery perspectives on motor learning based on EEG
Hayashi, Yuko, Graduate School of Ritsumeikan University; Matsumoto, Sayaka, Sakuma, Haruo, Ritsumeikan University

Motor imagery plays an important role in the promotion of motor learning and sports performances. It is known that there are two imagery perspectives in making a motor imagery and they influence on the skill of motor performance; one is internal imagery perspective in which the imager looks through by his or her eyes on their imaging experience, and the other is external imagery perspective in which the imager is looking at oneself from outside like a picture. The purpose of this study was to investigate the effects of motor imagery perspectives on motor learning by assessing EEG and the indexes about action movements. The task was raising a hand in response to the model pictures which model raised right or left hands on the front or back view. Subjects were required to raise their hands as fast as possible and correctly and to make imagery of their actions by internal or external perspectives while they were doing the task. Reaction times and percentage of correct action by each task and the EEG (electroencephalogram) in pre rest condition and during tasks from 13 regions (Fp1,Fp2,F3,F4,Fz,C3,C4, Cz,P3,P4,Pz, O1,O2) were measured. After each task, it was assessed by using a seven-point Likert scale about the degree of difficulty and concentration to the task. Reaction times and percentage of correct action were related to the quality of motor imagery, and they were faster in matching condition (stimulus/action). Results suggested that the difference of brain activity in perspectives of the motor imagery was related to the performance.

The effects of observing a learning model (or two) on motor skill acquisition and retention
Hebert, Edward, Southeastern Louisiana University

Modeling is commonly used to convey information to learners, and has profound effects on skill acquisition. While modeling typically provides a demonstration of correct or preferred movements, Adams (1986) and others found learning is also enhanced by observing a "learning model," who is practicing a task, receiving feedback, and improving. Dyad practice, which also includes peer observation, has also been shown to be more effective than practicing alone. The effect is proposed to be due to the observer engaging in problem-solving, error detection, and strategy evaluation (Adams, 1986; Blandin & Proteau, 2000; Lee & White, 1990). The purpose of this study was to extend this research by comparing the relative effects of observing 1 or 2 learning models on the acquisition of a motor skill, and also examine reports of what observers believe they learn during observation. Two experiments were conducted, both involving college students learning a 3x6x3 cup stacking task. In Experiment 1, 93 participants practiced the task in triads. P1 performed 20 trials the task, while P2 and P3 observed. P2 then performed 20 trials, while P3 observed. Finally, P3 performed the task. Analysis of performance scores, grouped into blocks of 5 trials, indicated all three groups improved during physical practice; and significant differences were observed between all 3 groups (P3>P2>P1). Experiment 2 used similar methods, but allowed observation of 2 peers

by all 3 participants in each triad, and added a retention test and a survey on which participants reported what was learned during observation. Analysis revealed significant improvement by all groups, and significantly better performance by both P2 and P3 than P1. Survey responses indicated observers learned strategies (e.g., putting cups close together, working on one stack at a time from right to left), with P3 reported learning more strategies than P2. These results indicate that observing a learning model (or two) enhances skill acquisition, and provides insight into the types of cognition occurring during observational learning.

Deceptive and non-deceptive penalties in team handball: Linear classification and characterization of movement patterns

Helm, Fabian, Munzert, J., Department of Psychology and Sport Sciences, Justus-Liebig-University Giessen; Troje, Nikolaus F., Department of Psychology, Queen's University

Athletes are often asked to adapt their behavior to constantly changing environmental conditions. Action prediction can make it easier to achieve such behavioral goals. However, in many situations, athletes attempt to manipulate this process in order to deceive their opponent. Nonetheless, opponents can detect the actor's intention by observing their movement kinematics. Real and deceptive actions typically display a degree of spatiotemporal dissimilarity in terms of the motion trajectories and the temporal dynamics of the movement kinematics. Successful deception depends on keeping this dissimilarity small. In the present study, we examined differences in deceptive handball penalties between elite and novice athletes. We analyzed the motion data of 1,580 (788 deceptive) 7-m penalties with linear discriminant (LDA) and dissimilarity analysis. Results of the LDA showed that the discrimination of deceptive and nondeceptive throws was less accurate for penalties performed by elite field players (96.4%) compared to those of novices (99.0%). Elite field players produced deceptive throws that were clearly more similar to nondeceptive ones. Results of the dissimilarity analysis revealed that spatial dissimilarities and variations between the two types of throws were significantly smaller in elite compared to novice field players ($p < .001$). Temporal dissimilarities did not differ significantly between groups. We conclude that extensive training and the associated acquisition of expertise in performing deceptive movements results in the ability to perform deceptions that are highly similar to real movements. Furthermore, our data demonstrate that performing successful deceptions depends mainly on keeping spatial dissimilarities small.

Searching for the optimal focus of attention in running

Hill, Antje, Schucker, Linda, University of Muenster (WWU); Hagemann, Norbert, University of Kassel

Studies on attentional focusing in endurance sports exhibit a decreased running economy when adopting an internal focus of attention compared to an external focus (e.g. Schucker et al., 2009, 2013). However, up to now, no study was able to find a focus with a clear advantage over a control condition, where no focus was instructed. The aim of this study was to provide a comprehensive comparison of attentional foci by implementing two relevant internal, an external and a control condition. Thirty-one recreational runners performed a 24-min-run at moderate intensity consisting of 4x6 min counterbalanced blocks. They were instructed to focus on (1) internal body signals and perceived exertion, (2) a video showing a running track, (3) their running movement, (4) what they are used to focus on in training (control condition). The blocks passed over continuously and the participants were constantly asked to rate their level of perceived exertion (RPE, Borg, 1998). To determine running economy oxygen consumption (VO2) was assessed by spiroergometry. Repeated- measures ANOVA showed a significant difference between the four conditions in terms of VO2, ($F(3,90)=11.29$, $p<.001$, $\eta 2=.28$), as well as of RPE ($F(3,90)=6.06$, $p<.001$, $\eta 2=.17$). Post-hoc comparisons with Bonferroni adjustment revealed significantly lower VO2 values for the external focus compared to all other conditions (all $p<.01$, $d=.54$-$.76$). For RPE, post-hoc tests showed a significantly higher perceived exertion for the focus on inner bodily signals compared to all other conditions ($p=<.01$, $d=.53$-$.83$). This study provides a basis for comparison between different relevant attentional foci and is the first to show a clear advantage of an external focus of attention compared to a control focus in a sample of recreational runners.

Self controlled learning and goal manipulation: Does "too easy" and "too difficult" affect the self-control paradigm?

Ho, Rachel, Wu, Wilbur F.W., California State University Long Beach

Daily life requires individuals to learn motor skills and adapt to a variety of environments and tasks, and therefore practice must occur to promote translation of motor skills into permanence. Research has established principles of practice, shaping an ideal climate for motor skill learning (Magill, 2001); this has produced a traditional view of learning as a one-way interaction between instructor and participant. However, in the learning and cognitive fields it has been well established that a two-way interaction between instructor and participant is more beneficial for learning (Zimmerman, 1986). Bandura (1986) suggested that more control be given to the learner forging a climate where learners would have control of how they learn and be actively involved during the learning process. Within Motor Control and Learning, this is known as self-controlled practice. The purpose of this study is to determine how goal manipulations influence the process of self-regulation that drives self-controlled learning environments. It was hypothesized that there will be a difference in learning between the self-controlled group and a yoked group as well as a difference in learning between the self-control groups with respect to stringency of the timing goal. One hundred and twenty young adults participated in this experiment. Participants in the self-control group were provided control over the amount of practice trials they completed during practice while participants in the yoked group received the same amount of practice trials as the individuals they were yoked. Additionally, participants were grouped according to timing goals. Measures of constant error, absolute error, relative timing error, and variable error were collected to assess changes in performance. Results suggest differences in self-control vs. yoked groups as well as stringency of the timing goal. An analysis of variance showed that the effect of timing goal was significant for the length of practice, $F(2,57) = 9.421$, $p = 0.00$. These results suggest that disparate goals affect self-controlled paradigms.

Mobility differences exist between races in older women

Hondzinski, Jan M., Kosma, Maria, Louisiana State University; Buchanan, David R., University of Massachusetts; McDougal, Devin R., Strain, Claire, Louisiana State University

Only a small percentage of older African-American (Black) women (OAAW) living in high-poverty urban areas meet nationally recommended activity guidelines, yet few research studies focus on motor performance declines and associated falls risk that may exist for this population. The purposes of this study were to 1) report the physical function of OAAW, 2) compare their results to those of older White-American women (OWAW) living in middle class suburban areas, and 3) determine associations between age and measures of physical function and fall risk. Methods: Data were from 14 OAAW and 9 OWAW. Bilateral plantar pressure, measured with Semmes Weinstein monofilaments, indicated compromised protective foot sensations (score < 5). Measures of physical function included the timed-up-and-go (TUG) for quick mobility, the dynamic gait index (DGI) for complex gait performance, the six-minute walk (6MW) for endurance, and the area and velocity of center of pressure for standing balance with eyes open. Results: Although 57% of OAAW and 33% of OWAW had compromised foot sensations, most OAAW and all OWAW maintained a low fall risk and were within normal limits for endurance, mobility, and balance. TUG distributions in the two groups differed significantly (Mann-Whitney U = 18, n(OAAW) = 14, n(OWAW) = 9, P < .01 two-tailed) with a median duration of 8.8s for the OAAW larger than the median duration of 7.6s for the OWAW. Significant correlations for all participants revealed that DGI and 6MW scores decreased with age (r = -.56, P = .006 and r = -.45, P = .03, correspondingly), while TUG scores increased with age (r =.65, P = .001), indicating worse physical function approaching greater fall risk with increased age. Median TUG score of 11.4s for the oldest AAW also exceeded that of the oldest WAW (8.1s). Conclusion: OAAW can achieve similar ambulation, endurance, and balance compared to OWAW, yet when required to move their bodies quickly, the oldest AAW move slower than the oldest WAW, which may place them at a greater risk for falls sooner than their White counterparts.

Brain imaging paradigm shows promise for attentional focus research: A feasibility study using functional magnetic resonance imaging

Hooyman, Andrew, Dorton, Hilary, Alves, Jasmin, Walter, Nathan, Winstein, Carolee, Lewthwaite, Rebecca, Tjan, Bosco, University of Southern California

Relative to an internal focus, an external attentional focus on movement effects has consistently been shown to benefit motor performance and learning (Wulf, 2013). Research to uncover the neural substrates that mediate this behavioral effect is limited. This study aimed to assess feasibility of a functional magnetic resonance imaging (fMRI) paradigm for identification of neural substrates engaged in these two attentional focus conditions of practice. This study extends previous work by utilizing a force-production task, within-subject design, and higher resolution scanning. Methods: We chose a within-participant design, to minimize effects of individual difference in task-related blood oxygen dependent level (BOLD) signal. We scanned two right- handed young adults (female; mean age 24 +/- .57) while they performed a complex tracking task by compressing a thin rubber pad with the dominant right hand to control movement of a cursor. Participants completed 4 scan blocks of ten 24-second task trials, interleaved with ten 12-second visual cue presentations. The cue (an "I" (internal) or "E" (external)) served as non-movement, rest blocks and allowed performers to mentally switch between attentional strategies. Cue order was randomized to minimize anticipation. Total set-up and scan time was less than 1 hour. Analysis and Results: We performed whole brain analysis and between-condition subtraction. Raw data were corrected for head motion and any data that had head motion correlated with the task was excluded. A group (n = 2) analysis of E-I showed E > I activation in the left post central gyrus, contralateral to the moving hand. While I-E showed I > E activation in the left frontal pole. These results using 2 subjects, identified clear condition specific activation patterns, consistent with previous work (Zentgraf et al., 2009). Overall, we conclude: 1) this motor behavior-brain imaging paradigm is feasible for determining the neural substrates of attentional focus, and 2) it can be reliably implemented in a larger fully powered study.

Effects of target pre-cueing on quiet eye and movement preparation time: Evidence for heuristic pre-programming?

Horn, Robert R., Marchetto, Jonathan D., Montclair State University

Vickers (2009), suggested that quiet eye (QE) is used to program the movement parameters in an aiming task. While evidence indicates that QE is longer in tasks requiring more frequent reparameterization and in tasks of greater complexity, researchers have not substantiated whether such programming is limited to the QE period. In this experiment we examined the impact of the precision of target pre-cues on QE and other time periods in dart throwing. If movement parameters are programmed exclusively during QE, then target pre-cues should not affect QE duration. In contrast, shorter QE duration after the pre-cueing of targets implies some heuristic pre-programming process may have occurred before QE. Sixteen participants threw darts from 2 m away to a target (a red circle) projected onto a soft screen. Prior to target presentation, an area of the screen was highlighted. The target would then appear anywhere in that area. The pre-cueing highlighted areas were either the full screen (no cue), or any half, quarter, or sixteenth of the screen. Participants threw eight times in each of those four conditions, which were presented in random order. Dependent measures were programming QE (PQE; final fixation until movement initiation), time to QE onset (QEON; target presentation to initiation of QE), movement preparation time (MPT; target presentation to initiation of movement); online QE (OQE; QE phase post initiation of movement) total QE (TQE; PQE + OQE), and radial error (cm). Repeated measures ANOVA with Tukey HSD tests ($p<.05$) revealed that PQE was shorter when the target was pre-cued in the most precise one-sixteenth condition, compared to the no cue condition. Also, MPT was shorter when pre-cued in the one-sixteenth condition than in either the no cue or half screen conditions. Target pre-cueing conditions did not affect OQE, TQE, QEON, or radial error. Shorter PQE after more precise target pre-cuing implies that less programming was required in QE, perhaps due to some approximate or heuristic pre-programming mechanism.

Identifying units of movement in discrete movement trajectories

Hsieh, Tsung-yu, Liu, Yeou-Teh, Lin, Bo-Cheng, National Taiwan Normal University; Newell, Karl, University of Georgia

Woodworth's (1989) initial investigation distinguished the role of a current control phase from the discontinuous trajectory of movement and showed that it is a main factor for movement accuracy. The existence of submovements underlying movement kinematic trajectory has been the focus of many studies. Here we contrast 3 direct and objective movement algorithms to detect submovements: 1) traditional zero crossing (e.g., Carlton, 1980); 2) zero line crossing in acceleration profiles with specific amplitude (10 % peak acceleration) and interval (72ms) (e.g., Chua & Elliott, 1993); and 3) minimum peak jerk 200cm/s3 (e.g., Shmuelof, Krakauer & Mazzoni, 2012) by using the space-time movement outcome with a range of spatial (10 - 30cm) and temporal (250 - 2500ms) constraints in a discrete aiming task. 12 participants completed 3 distances x 5 time conditions each with 100 trials and the order of different space- time conditions was randomly assigned for each participant. Repeated measure ANOVA showed a significant interaction effect of detecting methods and different space-time conditions ($p<.05$). The distribution of number of submovements shifted from positive skewness (fast) to negative skewness (slow). Only the minimum peak jerk algorithm showed approximately a normal distribution in the middle speed conditions. In fast conditions, using the algorithm of searching in acceleration profile detected similar percentage of trials with submovements as minimum peak jerk and zero crossing methods. However, it was inappropriate to determine meaningful parsing point due to many irregularities in the kinematics of profile in slow conditions. In addition, only detecting the zero crossing to differentiate profiles without defining specific amplitude/duration may not be sufficient to exclude the potential tremor/noise from data recording. The findings show that the 3 algorithms give similar findings in the time minimization conditions of a Fitts' law protocol but differences increasingly arise in the slower time matching speed-accuracy conditions.

Psycho-social factors that cause the difference between actual movement capability and self-perceived ability of upper extremity for stroke patients

Hsu, Stephen, Chen, Shuya, China Medical University

Introduction: After stroke, many survivors have impairments on one side of their body, making the disease a leading cause of long-term disability. Previous evidence suggested that, for stroke patients, upper extremity (UE) function is more important for independent daily living compared to lower extremity (LE). However, rehabilitation programs for stroke have been more successful in restoring function in the LE than in the UE. Previous researchers found out that the improvement stroke patients had made during therapy often deteriorate outside the clinic environment. Furthermore, results of previous study showed that the factors influencing UE recovery are primarily physical factors, including neurophysiologic factors and motor behavior factors. Therefore, in this study, we would like to explore the psycho-social factors that influence UE functional recovery outside the clinic environment. Methods: The database searched included PubMed, CINAHL, Cochrane Library, and Web of Science. The keywords we used were stroke, arm, recovery of function, factors and their synonyms. Inclusion and exclusion were developed and applied to further refine the search. Result: There were 659 studies found (PubMed: 178, CINAHL: 193, Cochrane Library: 220, Web of Science: 68). Based on the inclusion and exclusion criteria, we have scrutinized 20 of them. Among 20 studies, there were 15 studies referring to psychological factors and 5 studies referring to social factors. Psychological factors were post-stroke depression (n=6), anxiety (n=2), negative mood (n=1), learned nonuse (3), and self-efficacy (n=3). Social factors were limited caregiving skills (n=2), and lack of social support (n=3). Conclusion: The results showed that other than physical factors, psycho-social factors may become equally important to influence upper extremity functional recovery in daily life after stroke. The identification of these psycho- social factors would suggest more comprehensive rehabilitation programs.

Combined visual-kinesthetic training alleviated visual dominance effect in visual learning of bimanual coordination

Huang, Shaochen, Zhu, Qin, University of Wyoming

Learning a novel pattern of bimanual coordination entails learning the visual or kinesthetic information about relative phase (Wilson et al., 2003, 2010; Snapp-Childs et al, 2015). According to the practice specificity hypothesis for motor learning (Proteau et al., 1992), better performance should show in the condition that resembles the training condition. Previous studies (Mirich et al., 2014 and Huang et al., 2015) have shown that learning a novel pattern of bimanual coordination with visual information yielded a better retention performance only when the visual information was available. This vision-specific learning effect was referred as the visual dominance effect in perceptual-motor learning of bimanual coordination. In this current study, we recruited 18 participants to learn the 90" coordination pattern. They were split into half with age and gender matched. One group was trained with visual information, and the other group with the combined visual and kinesthetic information (5 in visual-kinesthetic order, and 4 in kinesthetic-visual order). The percentage of time on task (PTT) was tested before and after training in both visual and kinesthetic conditions, and the improvement of PTT was calculated. The results showed that the visual training yielded greater improvement in the visual testing condition as opposed in the kinesthetic testing condition (t-pairwise = 4.42, $p<0.05$). The combined training yielded the same amount of improvement ($p>0.05$) in both visual and kinesthetic testing conditions, which was however greater than that demonstrated by the visual training group in the kinesthetic testing condition ($p<0.05$). Hence, we conclude that the combined visual-kinesthetic training could alleviate visual dominance effect to enhance the effectiveness of using visual information to learn bimanual coordination.

Effects of treadmill walking with visual feedback on gait outcomes in people post-stroke

Hurtado, Ileana, Cailfornia State University, Northridge; jung, taeyou, Jara, Mai, vrongistinos, konstantinos, lopez, michael, mbanugo, nnamdi, Gorospe, Jon, California State University Northridge

Compromised gait is prevalent in people post-stroke. Gait training is one of the major components in stroke rehabilitation. Treadmill walking is often used for gait training in people post-stroke. Limited studies have examined the effects of a visual feedback system in combination with treadmill-based gait training. Purpose: The purpose of this study was to investigate the effects of treadmill walking with real-time visual feedback on gait outcomes in

people post-stroke. Methods: 8 participants (age 56.37+/-32.37 years old) participated in this preliminary study. They were randomly assigned to either the visual feedback gait training group or the control group. Both groups performed 30 minutes of treadmill walking, three times a week, for eight weeks. The control group performed the training with no visual feedback (NVF) while the experimental group received real-time visual feedback (VF) on a LCD screen which displayed foot placement and prompts. Data collection was performed before and after the eight weeks. The kinematic and spatiotemporal variables were recorded and analyzed by using a 3D motion analysis system. Results: VF group showed greater improvements in gait symmetry index of cadence, stance-swing ratio, and hip joint kinematics as compared to control. VF group increased gait symmetry index of cadence, stride length, stance-swing ratio and joint kinematic symmetry in the knee and hip. Control group showed improvements in cadence symmetry and hip joint kinematic symmetry. Conclusion: The findings indicate that gait training with visual feedback can be more effective in improving gait symmetry than conventional treadmill walking.

Timing adjustment strategies in football kicking using body movement

Ikudome, Sachi, Nakamoto, Hiroki, Mori, Shiro, National Institute of Fitness and Sports in KANOYA

Ball kicking in motion is a frequently used and important skill in football; Gentile (2000) categorized this skill as the most complex skill, which includes in-motion regulation with body transport, inter-trial variability, and object manipulation. The present study examined the timing adjustment strategy that contributes to experts' successful performance of this complex skill. Five college football players (experts) and six non-football college athletes (non-experts) participated. They moved toward a moving target that was simulated by successive illumination of 200 LEDs and kicked a ball according to the arrival of the target with as little temporal error as possible. In this case, they did not receive any instruction about when and how to move. Additionally, they needed to adjust their kicking timing between trials because slow (2 m/s) and fast (4 m/s) targets were randomly presented in the session. As a result, the experts showed significantly smaller temporal errors for the fast target compared to the non-experts ($p < .05$), while there was no significant difference for the slow target. Additionally, each group showed a different timing adjustment strategy; while the experts adjusted their movement time in response to two target velocities, the non-experts mainly adjusted their reaction time. This reveals that experts achieve successful timing by judging the time-to-contact and adjusting their timing in motion. The second experiment required participants to perform the task under two different conditions; movement would need to take place either 1) before judging two target velocities or 2) after judging two target velocities. Both groups showed a smaller temporal error for only the fast target in the first condition compared to the second condition, although clear statistical significance was not demonstrated. These results may suggest the efficacy of the in-motion regulatory strategy, which includes the perception of object and body movement while moving, for successful timing adjustment in complex interceptive skills.

Power training improves static balance in Parkinson's disease

Intzandt, Brittany N., Beck, Eric N., Wilfrid Laurier University; Silveira, Carolina R.A., University of Waterloo; Almeida, Quincy J., Wilfrid Laurier University

Increased sway variability during static balance in Parkinson's disease (PD) has been linked to greater risk of falls. This maladaptive behaviour has been theorized to be due to impaired multisensory integration, and thus may be a potential target for rehabilitation. High velocity strength training (PT) improved static balance in healthy older adults, but the effects of PT on static balance in PD remains unknown. Thus, the purpose of this study was to investigate whether PT would lead to greater improvements in static balance in individuals with PD than a regular strength training (ST) program. Individuals with idiopathic PD were randomized into a PT (n=13) or a ST (n=15) program. The programs were identical except for the concentric movement velocity, where the PT group completed this as fast as possible. Both groups trained twice per week for 12 weeks. Static balance was evaluated before and after training, where they performed three 30-second trials with eyes open (EO) and eyes closed (EC). Sway variability was compared pre and post, between groups, and across all trials for both EO and EC tasks. A time by task by group interaction approached significance in anteroposterior sway variability ($p=0.056$), revealing that only the PT group reduced AP variability after the intervention in the EO task, while both PT and ST groups decreased AP variability in the EC task. Mediolateral changes or overall stability index were not significant. Findings from this study indicate that both PT and ST can improve variability of sway during EC, but that PT benefited further by also

reducing their variability in EO. Since sway variability was reduced, results support muscle strength improving the utilization of proprioception in PD. As the PT group seemed to receive further benefit as shown in the EO condition, it could be interpreted that muscle power (a function of strength and velocity) is a unique intervention to reduce sway variability (and has the potential to reduce falls) in PD with more severe balance impairments present in eyes closed situations.

Visual search behaviors while rebounding the basketball
Ishibashi, Yukimasa, Meio University

In basketball games, the possession of the rebounding ball is one of the most important statistical data to win the game. The basketball player, therefore, is required both to percept the temporal and spatial information through the visual field and to coordinate the catching action while rebounding the basketball. Previous studies showed experienced players utilized the properties of ambient vision system immediately for receiving visual information broadly to react to the opponent player immediately before their catching action only. The aim of this study, therefore, was to examine visual search behaviors and catching actions of experienced basketball players when they rebound the basketball in order to understand the mechanism of perception-action coupling. Experienced male players were participated in this experiment. Subject's experimental task was to catch the basketball in basketball 3-on-3 situations. Each subject played as a defensive player and was fitted with eye-tracking device (EMR-9, NAC Inc.) to acquire his viewing point for the detection of visual search behaviors. Subjects' kinematics data was also captured by the video cameras and all video recordings were synchronized with the eye movement data. The results showed that experienced players had small distribution of viewing angle around origin during moving phase. The different fixation locations and visual search patterns were discussed whether they were moving or not. The visual search behavior and catching action was coordinated with the basketball's trajectory information to pick up important advanced cues. The visual search behavior supported catching actions planning by cues positions where the basketball was directed consequently. Therefore, an effective visual search behavior was one of the important factors to increase the chance of rebounding the basketball.

Does the observer egocentrically perceive a model image during a right-and-left discrimination task?
Ishikura, Tadao, Doshisha University

With regard to the model demonstration of motor skills, it is reported that observation from the model's rear had a more immediate learning effect than did observation from the model's front. However, it is not clear whether this difference is mainly influenced by allocentric spatial physical orientation on the basis of the environment or by egocentric spatial physical orientation points on the observer's body. Therefore, this study aimed, using a wooden doll, to examine the speed of the right-and-left discrimination of raising of the hand and the event-related potential (P300) for evaluating cognitive load. Eleven university students observed the following: the objective model, which presented poses from the model's front; the subjective model, which presented poses from the model's back; and the specular model, which presented poses from the model's front and reversed the left-right orientation, as in a mirror image. The participants were asked to press the right key if the doll raised its right hand, and to press the left key if the doll raised its left hand (the specular observation in relation to the reverse). We predicted that response time and P300 amplitude would demonstrate a preference toward 'subjective approximate specular less than objective" if influenced by the relationship of the allocentric spatial physical orientation. Conversely, a preference toward 'subjective less than specular approximate objective" if influenced by the egocentric spatial physical orientation. The results showed that the response time was faster for the subjective model than for either of the others, and P300 amplitude was less for the subjective than the objective model. Therefore, for university students, it appears that the relation of the egocentric physical direction between the model and the observers becomes the main right-and-left discrimination point of reference for perceiving the model image.

Does random practice promote a more effective focus of attention than blocked practice?
Iwatsuki, Takehiro, Gushiken, Tanna, Brcic, David, Wulf, Gabriele, University of Nevada, Las Vegas

Do random versus blocked practice orders promote different attentional foci that, in turn, may contribute to different learning outcomes? We hypothesized that repeating the same movement in blocked practice might promote a non-

optimal focus of attention, such as an internal focus on body movements or a proximal external focus. In contrast, random practice might necessitate a more distal external focus as the intended movement outcome constantly changes (e.g., hitting a target from different distances). A distal focus has often been found to be most effective for learning. Thus, an interesting question is whether possible differences in attentional focus might play a role in the typically seen random versus blocked practice effects on learning. In the present study, two groups of non-golfers practiced putting golf balls to a target from different distances (120, 150, 180 cm) in a random or blocked practice order, respectively, for a total of 60 trials. Two days later, both groups performed retention (150 cm) and transfer (210 cm) tests. The random group had significantly smaller deviations from the target than the blocked group on the transfer test. To gain insight into participants' attentional focus, after each block of 20 practice trials, they were asked to rate the degree to which they focused on their arms, hands, shoulders (i.e., internally), putter, target, or distance to the target (i.e., externally). The random group focused significantly more on the distance to the target than the blocked group, whereas the blocked group focused significantly more on the putter than the random group. These results are in line with the idea that random practice promotes a more distal external focus – which may facilitate the random practice learning advantage. Follow-up studies will be necessary to confirm the superiority of a focus on the distance versus putter for this task. Nevertheless, the present findings suggest that learners' attentional focus may differ as a function of the practice schedule, with possible consequences for learning.

Prognostic utility of neuromotor and neurocognitive performance in predicting return-to-full-duty duration after a concussion in military personnel

Jakiela, Jason T., Ross, Scott E., Labban, Jeffrey D., Kuznetsov, Nikita A., University of North Carolina at Greensboro; Norris, Jacob N., McCarron, Richard M., Navy Medical Research Center; Haran, Francis J., Naval Submarine Medical Research Laboratory; Rhea, Christopher K., University of North Carolina at Greensboro

Approximately 320,000 military personnel have sustained a traumatic brain injury (TBI) since 2001, and it is unknown whether existing concussion assessment measures are informative regarding the duration it takes to return-to-full-duty (RTFD). This study performed a retrospective analysis of clinical assessment data from concussed military personnel. Neuromotor tests of balance [Balance Error Scoring System (BESS) and Sensory Organization Test (SOT)] and neurocognitive performance [Automated Neuropsychological Assessment Metric (ANAM)] were collected by trained military health personnel upon intake at the Concussion Restoration Care Center at Camp Leatherneck in Afghanistan on post-concussive military personnel (n = 85, 25.4 " 5.0 years). The associations of each test, as well as the prognostic utility, were determined with respect to a typical (< 14 days) or prolonged (≥ 14 days) RTFD duration. Pearson correlations performed between each measure and RTFD duration displayed a large, positive association for the ANAM simple reaction time score ($r = 0.51$, $p < 0.001$), a small, positive association for the BESS score ($r = 0.23$, $p = 0.03$), and a medium, negative association for the SOT composite score ($r = -0.41$, $p < 0.001$). Area under curve (AUC) from a receiver operating characteristic (ROC) analysis showed the ANAM provided good prognostic utility (AUC = 0.82), but that the SOT and BESS provided fair-to- minimal prognostic utility (AUC = 0.61 and 0.57 respectively) in predicting typical or prolonged RTFD. Each measure had poor sensitivity (SOT = 0.57, ANAM = 0.46, BESS = 0.30), but good specificity (SOT = 0.86, ANAM = 0.86, BESS = 0.81). These results suggest that the ANAM and the SOT had fair prognostic utility and were significantly associated with RTFD duration. The BESS test had little prognostic utility and a weak association with RTFD duration. Since each individual test lacked the desired level of prognostic utility, sensitivity, and specificity, a composite score that combines the three measures may provide a more appropriate method to examine RTFD duration.

Dual- and triple-task balance training improves the Timed-Up-and-Go in healthy older adults

Jehu, Deborah A., Paquet, Nicole, Lajoie, Yves, University of Ottawa

Falls are a major health concern in the older adult population. Preliminary evidence suggests that dual-task balance training may improve functional mobility in older adults. The objective of this study was to determine whether dual- or triple-task balance training could improve the time to completion of the Timed-Up-and-Go (TUG) in community-dwelling older adults. Fifteen participants in the Dual-task group (age: 70.2"3.2) and 15 participants in the Triple-task group (age: 68.7"5.5) trained one-on-one, 3x/wk for 12 weeks on a balance obstacle course while completing two or three tasks simultaneously, respectively. Fifteen participants in the control group received no training (age:

66.7"4.2). All participants performed 3 trials of the TUG, TUG cognitive (TUGC) and the TUG motor (TUGM) at baseline, at 12-week post, and at 12-week follow-up. Both training groups exhibited significantly faster TUG, TUGC and TUGM scores after the intervention compared to baseline. The control group exhibited significantly faster TUGC scores after 12 weeks with no improvements in TUG or TUGM scores. Both training groups were significantly faster on the TUG, TUGC and TUGM at the follow-up compared to the control group, but no significant differences emerged between training groups. These results suggest that both training groups significantly improved functional mobility after the intervention and sustained these improvements over time. These findings may have important implications for reducing fall risk in older adults.—*Ontario Graduate Scholarship, Internal Grant*

Independent contribution of acute exercise to protection of new procedural memory

Jo, Ji Seong, Chen, Jing, Wright, David L., Texas A&M University

There is growing evidence that an acute bout of exercise can provide a long-term memory benefit for procedural skills such as motor sequence tasks. Recently Rhee et al. (2015) demonstrated that an acute bout of cardiovascular exercise could provide some protection to novel procedural learning from subsequent practice with a new skill only two hours following initial learning. In this study, long-term retention was assessed after approximately 24-hrs which included a period of sleep prior to test performance. There is a well-documented positive influence of overnight sleep for procedural skill memory. Since test were not conducted in the absence of sleep, it is impossible to determine if sleep-dependent consolidation, either independently or by interacting with exercise-dependent consolidation, contributed to the protective benefit of acute exercise reported by Rhee et al. The present study was designed to further probe the role of acute exercise as a means of protecting prior procedural learning from subsequent interference. All individuals were exposed to practice with a pre-structured eight-element motor sequence task that was followed by a test phase conducted 6-hr later. When no additional practice was inserted during the 6-hr interval, individuals exhibited stabilization of the new acquired motor sequence reflected in test performance being similar to that observed at the conclusion of initial practice. In contrast, when practice of an alternative eight-element sequence was inserted one hour after practice with the target motor sequence, performance during the 6-hr test suffered significantly. Exposure to approximately 15-min bout of cardiovascular exercise after initial learning but prior to experiencing practice with the second bout of practice was expected to reduce the extent of interference revealing the existence of exercise-dependent consolidation that is independent of sleep-related memory processes. These data will be discussed with respect to the role of exercise in converting procedural memories from a labile to more robust state.

The influence of force production on reaction time in the contralateral limb.

Kennedy, Deanna M., Patel, Priya, Shea, Charles H., Texas A&M University

An experiment was designed to determine whether the initiation and/or release of force with one limb influenced the reaction time and associated production of force in the contralateral limb. Right-limb dominant participants were required to react with their left or right limb while either tracking a sinewave template by generating a pattern of force defined by the sine wave with the contralateral limb (bimanual dual task) or watching a cursor move through the sinewave pattern (unimanual control). During the task, a change in the color the waveform signaled participants to produce an isometric contraction with either the left or right limb as fast as possible. The signal to react was randomly varied across trials with 40% occurring while the cursor was moving up (dual task participant exerting force with their left or right limb), 40% while the cursor was moving down (dual task participant releasing force with their left or right limb), and 20% catch trials in which the signal to react was not presented. Reaction time was calculated as the time interval between the color change of the waveform and the initiation of the response with the required limb. Mean force reaction time with the left limb was significantly reduced when the right limb was initiating force while tracking the sign wave. During left limb reactions, reaction time was quicker for trials in which both limbs initiated force simultaneously as compared to trials in which the left limb initiated force while the right limb was producing or releasing force. Mean reaction time for the right limb was not influenced by the production or release of force by the left limb. This result is consistent with the notion that neural crosstalk can influence the time required to react to a stimulus, but this influence is asymmetric in nature with the dominant limb exerting a stronger influence on the non-dominant limb than vice versa.

Is the answer to prevention of sport traumatic brain injury right in front of our eyes?
Kiefer, Adam W.; DiCesare, Christopher; Cincinnati Children's Hospital Medical Center; Nalepka, Patrick; University of Cincinnati; Myer, Gregory D.; Cincinnati Children's Hospital Medical Center

Player-to-player contact underlies up to 70% of sport traumatic brain injury (sTBI) across contact- and collision-based sport. sTBI prevention has primarily focused on rule changes and safety equipment advances; however, no significant reductions in injury incidence rate have been reported, and in some cases researchers have actually observed injury increases relative to these endeavors. Alternative solutions are needed to reduce the injury burden and promote long-term, injury free participation in sport and physical activity. One solution for prevention of sTBI may exist in the form of visual perception, which plays a preparatory role in collision avoidance through the prospective control of avoidance maneuvers. Oculomotor control is foundational to the visuomotor control of injury avoidance behaviors, as they rely on attention to stimuli in the dynamic, useful field of view and rapid switching between various opponents and objects to quickly extract information from the visual scene. Prospective data will be presented from the performance of 15 healthy high school male hockey athletes (M = 16.50 " 1.17 years) during prosaccade, self-paced saccade and smooth pursuit tasks during the preseason. Regular season in-game collision data were monitored and recorded via helmet-mounted accelerometers. Simple linear regressions examined relations between oculomotor performance measures and collision incidence (≥ 20 g forces). The variability of prosaccade latency was positively associated with total collisions ($p = .05$, adjusted $R2 = 0.28$), as was the average self-paced saccade velocity ($p = .02$, adjusted $R2 = 0.37$) and variability of smooth pursuit gaze velocity ($p = .01$, adjusted $R2 = 0.47$). These results are an important first step toward understanding collision risk, and thus sTBI risk, in competitive contact sports for both primary and secondary head injury prevention.

Impact of prior random practice on the development of the initiation, concatenation, and execution processes associated with new motor sequence learning.
Kim, Taewon, Chen, Jing, Wright, David L., Texas A&M University

Recent work revealed that recent exposure to random (RP) but not blocked practice (BP) enhanced the acquisition of a novel motor sequence task. The present study was designed to examine the underlying reasons for the benefit of previous experience with RP for subsequent motor sequence learning. According to Abrahamse, et al., (2013) implementation of a discrete motor sequence (DSP) task involves independent initiation, concatenation, and execution processes which can be isolated by using pre- structured motor sequences. In the present work 6-key DSP tasks with the non-aging RSI after key 3 encouraged participants to execute these tasks as two motor chunks, each containing 3-elements. In this case, the time for Element 1 is assumed to capture the costs of sequence initiation, Element 4 reflects concatenation of the two motor chunks, whereas the remaining elements reflect only execution processes. The critical issue for the present work was to determine the role of each process to the benefit of previous RP for new learning. Individuals experienced either RP or BP 24-hrs prior to practice with a unique DSP task which was tested 24-hrs later. For the initial bout of RP and BP the expected benefit for RP was observed at retention. Preliminary analyses for new learning experienced 24-hrs after RP and BP revealed superior acquisition of the novel DSP following RP. This benefit was a result of faster implementation of initiation, concatenation, and execution processes during acquisition. Despite revealing superior execution for the novel DPS at retention RP participants did exhibit greater forgetting for this process suggesting some fragility in this component of new learning. *Support provided by the Sydney & JL Huffines Institute for Sports Medicine and Human Performance.*

Effects of Taekwondo intervention on balance in children with autism spectrum disorder
Kim, Yumi, Todd, Teri, Fujii, Takuto Jimmy., Jeng, Brenda, Vrongistinos, Konstatinos, Jung, Taeyou, California State University, Northridge

Children with autism spectrum disorder (ASD) have difficulty in maintaining balance compared to typically developing children. Balance deficit may inhibit children with ASD from acquiring basic motor skills, possibly limiting opportunities for engaging in physical activity. Taekwondo (TKD), a form of Korean martial arts, has shown to be effective in improving balance in children with and without disability. Purpose: To investigate effects of TKD training on balance in youth with ASD. Method: A total of fourteen children with ASD (ages 8 to 14)

participated in this study. Eight children with ASD completed TKD training twice per week for 8 weeks (50min per session). Six children with ASD received no intervention as controls. A computerized posturography system (NeuroCom Balance Master) in conjunction with a long forceplate was used to evaluate static (double and single leg stance with various test conditions) and dynamic balance (sit-to-stand and step-quick-turn). Balance was evaluated before and after the intervention. A mixed-model ANOVA was used for statistical analysis. Results: Following the 8-week intervention, the TKD group displayed significant improvements in single leg stance balance (Right leg with eyes closed condition) while the control group did not show change (p=.046). The TKD group also demonstrated greater improvement in the single leg stance balance (left leg with eyes open condition) after 8- week intervention as compared to their baseline (p=.014). The control group showed no significant difference before and after the intervention. Conclusions: Postural control for children with ASD improved following TKD training. Children with ASD also showed a high rate of adherence (92%) to the TKD training. Our findings suggest that TKD can be a fun and effective therapeutic option for balance improvement of children with ASD.

KR precision enhances accuracy of taekwondo jireugi accuracy?

Ko, Kyeong-Jin, Department of Sport Science at Chonbuk National University; Han, Dong-Wook, Chonbuk National University

The study addresses the effects of learning Taekwondo Jireugi accuracy on the precision of knowledge of results (KR) centered on the comparative study between the lower grades and the upper grades in elementary school. The participants in this study composed of 16 lower grades in elementary school and 12 upper grades in elementary school. Furthermore this study was to execute by dividing into the precise group and imprecise group. The quantitative knowledge of results like "0.5 second faster" and "1 second slower" was provided to the precise group. On the other hand, the qualitative knowledge of results in the forms of "faster" and ‘slower" was provided to the imprecise group. It was executed total 54 trials by dividing into 6 blocks as 9 trials/block. In case of retention and transfer phase, the experiment was executed by non-dominant leg after 24 hours. At the acquisition stage, this study showed out that the error values in the upper grades were statistically lower than those in the lower grades in the absolute error which did not consider the direction. On the contrary, there was no main effect and interaction effect on the independent variable in the constant error considering direction. Meanwhile, there were significant differences statistically in the variable error according to the block and age level. At the retention and transfer phase, there was no statistically significant main effect and interaction effect on all the absolute error, constant error, and variable error according to the age level and degree of KR precision. However, this study suggested some consistent tendency by the average value among the descriptive statistics of three values. That is, in case of lower grades the providing of precise KR had tendency of showing the lower error value in the retention and transfer trials, rather than the providing of imprecise KR. On the contrary, the upper grades had tendency of generally lower retention and transfer performance in conditions of imprecise KR.

Increased voluntary activation of the leg muscles during cycling interacts with transition to running in triathletes.

Kovacs, Attila J., Camic, Clayton L., Bradley, Lauren E., Durham, Emily A., Griffith, Patrick, Miller, Taylor L., Nelson, Alexandra, University of Wisconsin - La Crosse; Baweja, Harsimran S., San Diego State University

Regardless of their level of experience, triathletes report difficulties in transitioning to running after an intense bout of cycling. Recent evidence suggests that cycling may influence neuromuscular control of the subsequent running. Nevertheless, the specific neural mechanisms underlying this transition difficulty remain unclear. The purpose of this study was to identify aspects of neuromuscular control that may contribute to transition difficulties experienced by triathletes. Twelve competitive triathletes (ages 18-23 years) participated in the study. All subjects performed 4 sessions over two weeks. The first two sessions (counterbalanced) were used to determine the aerobic capacity and ventilatory threshold (VT) for running and cycling. The next two experimental sessions (counterbalanced) consisted of 40 minutes of cycling followed by a 10 minute run (C- R) or a 40 minute run followed by 10 minute run (R-R). Both experimental sessions were performed at the athlete's VT. Muscle activity (EMG) was recorded using surface electrodes from six leg muscles only during the experimental sessions. Muscle activity was quantified as EMG amplitude, relative timing of muscle activation onset and offset, and signal-to-noise ratio (S/N). EMG amplitude and timing of muscle activation were not different during post-transition running for both conditions. Regardless of

conditions, the S/N increased during the initial 40 minutes of cycling (C-R) and running (R-R). Furthermore, after transition a significant change in S/N was detected for the C-R condition, but not R-R condition. Our results suggest a gradual adaptation and increase in efficiency of muscle activation during the initial long bout of exercise. The difficulty in transitioning from cycling to running appears to originate from a sudden decrease in S/N for the C-R condition when compared with the R-R condition. In sum, our findings suggest that performing highly repetitive movements increase the task specific voluntary drive to the muscles and impedes transition to a different repetitive activity.

Scaling of visually presented augmented feedback affects automatization in motor skill learning

Krause, Daniel, Zobe, Christina, Paderborn University; Blischke, Klaus, Saarland University; Baumeister, Jochen, Paderborn University

A markedly reduced frequency (i.e. 14%) of visually presented error-feedback has been shown to effectively promote motor skill automatization, operationalized as dual-task cost reduction. In contrast, substantially higher visual feedback frequencies are thought to induce attentional controlled error processing, thereby impede motor automatization (Agethen & Krause, 2016; Krause et al., 2016). This frequency-specific automatization effect was not replicated when substantially larger error bars were used (Zobe et al., 2016), than had been applied earlier. We conjectured small-sized error-visualizations to be perceived less relevant than large-sized ones, thus inducing less attentional commitment. We tested this hypothesis on two groups of participants (n = 19 each), who practiced an elbow-extension-flexion-task in a pre-posttest design (720 trials; 5 sessions). They were instructed to execute this task within a time limit of 1200 ms as precisely as possible with regard to three movement reversal points (70", 20" and 70" in relation to the starting position). Error-feedback was presented according to a fading schedule (14% total feedback frequency), with one vertical bar for each reversal point visualized on a screen. Scaling of error bars was systematically varied between groups: i.e. a respective spatial error would be visualized in the large-size-group with 100 pixels on the screen (as in Zobe et al., 2016), in the small-size-group with only 40 pixels (down-scaling factor = 0.4). Automatization was measured according to the secondary-task paradigm (primary task prioritized) with an n-back task. Movement precision was measured as the mean absolute spatial error. While the small-size-group reduced dual-task costs from pre- to retention-test, p = .045, eta^2 = .20, the large-size-group did not so, p = .468; eta^2 = .03. There were no group differences in the pre-post change of absolute error, p = .518; eta^2 = .01. Thus, reducing the size of visually displayed error bars seems to facilitate motor automatization without affecting movement precision.

Motor learning in Parkinson's disease: The impact of context on individuals with mild cognitive impairment

Kuo, Yi-Ling, Petzinger, Giselle, Fisher, Beth, University of Southern California

Parkinson's disease (PD) has long been recognized as a movement disorder. It is now understood that non-motor symptoms including cognitive impairments are early and significant deficits in PD. In fact, a significant number of people with PD show mild cognitive impairment (PD-MCI) - a mild decline in mental abilities. However, it is unclear how MCI interacts with motor capability and specifically motor learning in PD. We recently demonstrated that people with PD without MCI were capable of learning a finger sequence task but showed greater context-dependent learning (CDL) compared to healthy controls. CDL is a phenomenon whereby people demonstrate better performance in the context in which they originally learn a skill but perform less well in a novel context. We hypothesize that individuals with PD-MCI with known impairments in attentional flexibility will demonstrate impaired learning as well as CDL. Seven patients with known PD-MCI were recruited. A finger sequence motor learning task was used to investigate CDL. Three numerical sequences were embedded within different contexts: colors and locations on a computer screen. Performance was measured as the total time and accuracy of finger tapping for each sequence. Total time accuracy cost (TTAC, time/accuracy) was recorded for both acquisition (day 1) and retention (day 2). Retention performance (TTAC) was measured under two conditions: SAME (unchanged context) and SWITCH (changed context). CDL was examined using switch cost ([SWITCH-SAME]/SAME*100%). Improved TTAC during acquisition was retained, as evidenced by no difference (p=0.73) between end of practice performance and the SAME retention test condition, indicating that individuals with PD-MCI were capable of learning the finger sequence task. For the SWITCH condition, TTAC was larger than in the SAME condition (switch cost=56.9, SD=144.0). However, this difference was not significant (p=0.34). Individuals

with PD-MCI were capable of learning a new motor task, but the impact of context shift was not evident given our preliminary results.

Shooting penalty kicks as accurately as possible: The goalkeeper has no impact on the penalty taker
Kurz, Johannes, Hegele, Mathias, Munzert, Joern, Justus-Liebig-University Giessen, Germany

When performing penalty kicks, soccer players can follow either a keeper-dependent (KD) or a keeper-independent (KI) strategy (Van der Kamp, 2011). In the KI strategy, penalty takers totally ignore the actions of the goalkeeper. They select the corner in which they want to shoot before the run-up and do not change it afterwards (Navarro, Van der Kamp, Ranvaud, & Savelsbergh, 2013). The present study examined gaze behavior and task accuracy while taking penalties in soccer in the natural environment of the soccer field (goal size: 7.32 x 2.44 m; distance: 11 m). The task was to shoot as accurately as possible into a specified corner (lower right or upper left) during three conditions (no goalkeeper, goalkeeper waving arms without a reaction, and goalkeeper waving arms with a reaction). Ten male skilled competitive penalty takers with an average of 16.6 years of experience performed a total of 48 penalties in a randomized order (3 conditions x 16 kicks). Results showed no significant differences between the three conditions in gaze behavior and shot accuracy, $F(2, 82) = .44$, $p = .65$, $\eta p2 = .01$. Furthermore, the data showed that during the run-up, the penalty taker fixated exclusively on the ball or the area around the ball. This was particularly the case for the last fixation before foot"ball contact. The target is looked at just before the run-up. It is concluded that the present data show that it does not matter what happens around the penalty taker as long as she or he wants to shoot precisely. During the run-up, the primary focus is on foot"ball contact, because this is the major subgoal determining shoot accuracy. Navarro, M., Van der Kamp, J., Ranvaud, R., & Savelsbergh, G. J. (2013). The mere presence of a goalkeeper affects the accuracy of penalty kicks. Journal of Sports Sciences, 9, 921"929. Van der Kamp, J. (2011). Exploring the merits of perceptual anticipation in the soccer penalty kick. Motor Control, 15, 342"358. *German Research Foundation (DFG), DFG-TRR 135*

Reaching and grasping in a natural environment: Task difficulty still matters
Kurz, Johannes, Justus-Liebig-University Giessen, Germany; Hegele, Mathias, Justus-Leibig University, Giessen, Germany; Reiser, Mathias, Munzert, Joern, Justus-Liebig-University Giessen, Germany

Gaze behavior is determined primarily by the probable location of the information needed for the ongoing or next action (Land & Tatler, 2009). Hayhoe, Shrivastava, Mruczek, and Pelz (2003) demonstrated this using the peanut butter sandwich paradigm. They showed that task affordances rather than the salience of the visual environment play a major role in guiding gaze behavior. The present study examined kinematics and gaze behavior during series of transport movements of water glasses (10 series x 16 trials). The difficulty of movements was manipulated by using water glasses with different filling levels: the highest difficulty was a completely filled glass; the lowest difficulty, a 76%-filled glass. It was hypothesized that task difficulty (defined by the filling level) would influence the peak velocity and duration of movements while also having an effect on their visual control. Results showed that difficulty impacted on the duration of the transport movements, $F(1.98, 631.65) = 532.10$, $p < .001$, $\eta p2 = .63$, and their peak velocity, $F(2.97, 948.73) = 662.59$, $p < .001$, $\eta p2 = .68$, as well as the percentage of time spent viewing the glasses, $F(3.83, 1110.84) = 217.29$, $p < .001$, $\eta p2 = .43$, and viewing the target, ($F(3.82, 1106.29) = 172.81$, $p < .001$, $\eta p2 = .37$. Furthermore, difficulty affected the timing of gaze control and increased the number and duration of evaluation fixations. It is concluded that the present data support current literature indicating that gaze is not only directed toward locations that are relevant for reaching (sub)goals but also task-specific. They also show that both the kinematics of transport movements and gaze behavior are influenced by task difficulty. Hayhoe, M. M., Shrivastava, A., Mruczek, R., & Pelz, J. B. (2003). Visual memory and motor planning in a natural task. Journal of Vision, 3, 49"63. Land, M. F., & Tatler, B. W. (2009). Looking and acting. Vision and eye movements in natural behaviour. Oxford, England: Oxford University Press.—*German Research Foundation, IRTG 1901, SFB-TRR 135*

Reliability of movement timing metrics provided by a portable gait assessment protocol
Kuznetsov, Nikita A., Cone, Brian, Schleich, Kristen N., Guthmann, Deborah, Ross, Scott E., Long, Benjamin, UNCG Department of Kinesiology; Robins, Rebecca K., Wright, Geoffrey G., Temple University; Haran, Jay F., Rhea, Christopher K., UNCG Department of Kinesiology

Dynamic stability of walking is compromised in individuals who have sustained a traumatic brain injury (TBI). Detecting changes in neuromotor function after TBI is difficult in field-based settings and frequently requires subjective judgment due to limited access to laboratory equipment. To this end, we have begun designing a cost-effective Android-based smartphone application (the AccWalker app) to measure dynamic balance activity using a stepping in place task as a surrogate of gait. The aims of the current study were to evaluate the reliability of the AccWalker testing protocol in non-concussed individuals in terms of test-retest reliability (intraclass correlation coefficient; ICC) and absolute reliability (standard error of measurement; SEM). Healthy young adults (N = 48, M = 22.02 yrs, SD = 3.14; 25 men) were instructed to step in place for 120 seconds at a comfortable pace over 6 trials (3 sessions separated by 4 days on average, 2 trials per session). The mean stride period and the coefficient of variation (CV) were calculated for each trial from the vertical acceleration of the thigh recorded by the AccWalker installed on an HTC Desire 510. Results showed that the stride period was greater in session 1 compared to the following sessions, indicating a practice effect. Accordingly, the data from session 1 were not used in the reliability calculations. The two trials within session 2 and session 3 were averaged and an ICC(2,k) was used to calculate test-retest reliability. The results showed excellent test-retest reliability for stride period (ICC = 0.89) and adequate test-retest reliability for stride period CV (ICC = 0.70). The SEM values for both measures were 0.05 s and 0.46%. These results suggest that the temporal metrics obtained with the AccWalker app have adequate test-retest reliability when averages of two trials are used. These results will inform the development of the next version of the AccWalker protocol, with the goal to screen for significant deviations in the spatio-temporal parameters of gait in individuals after TBI.

Local muscle fatigue degrades motor learning in a positioning task

Lai, Qin, Datla, Gowtami, Rubino, Jena, Wayne State University

Recent studies showed that fatigue resulted in a decline in proprioception. But little known about whether fatigue-induced proprioceptive degrading affects skill acquisition and memory consolidation. The purpose of this study was to investigate how local muscle fatigue affected motor learning in an arm positioning task. In Experiment 1, 24 healthy, right handed young adults were randomly assigned into either control or experiment group. Both the groups performed the same task but the experiment underwent a fatigue protocol prior to each practice block during the acquisition. The protocol involved in biceps curls with weight of 80% voluntary contraction until fatigue. The task was to move a metal handle to 30, 45, 60 deg by flexion of the left forearm placed on a kinesthesiometer. All the participants performed 1 block of pre-test and 5 blocks of acquisition during the first visit. A delayed retention block and a bilateral transfer block were administered 48 hrs after that. Each block consisted of 12 practice trials. Participants were blind folded on all the trials and were given verbal feedback about performance for each trial of the acquisition only. A 2x5(Group vs. Block) ANOVA with repeated measure on Block for acquisition found both groups decreased total movement error (E) with practice ($p<.01$), but the fatigue produced more E relative to the control [$F(1, 22) = 4.95$, $p<.05$]. A separated ANOVA for retention and transfer showed fatigue degraded learning [$F(1, 22) = 10.19$, $p<.01$]. On Experiment 2, 12 healthy young adults were administered for the same task, but with fatigue protocol prior to every other block during 6 blocks of practice. Surface EMG on the agonist (biceps brachii) was recorded by a Biopac's system. An ANOVA analysis showed the sEMG on fatigue blocks had a higher frequency but a lower integrated area compared to non-fatigue blocks ($p<.05$). The present findings suggested that local muscle fatigue possibly increased noise for neuromuscular communication, and further distorted the representation of movement in long-term memory.

The reliability and validity of two motor skill assessments for use in school settings

Lander, Natalie, Barnett, Lisa M., Salmon, Jo, Deakin University; Logan, Sam W., Oregon State University; Morgan, Philip, Newcastle University

Proficiency in fundamental movement skills (FMS) positively correlates with cardiorespiratory fitness, healthy weight status, and physical activity. Assessment is a critical component in improving FMS, and many instruments have been developed to assess FMS in children. It is important to also be able to measure FMS competency in adolescent populations, particularly girls who are consistently less proficient than boys, yet these tests have largely not been validated and/or tested for reliability in this age group. The aim of the current study was to test the reliability and validity of two FMS assessment instruments in an adolescent population; the newly developed

Canadian Agility and Movement Skill Assessment (CAMSA), and the Victorian FMS assessment tool from Australia. A total of 34 Australian Year 7 girls were tested and retested on each instrument in a school setting. Test-retest reliability was excellent for the overall CAMSA score (ICC = 0.91) and for the isolated time and skill score components (time: ICC = 0.80; skill: ICC = 0.85). Test-retest reliability of the Victorian FMS assessment was also good (ICC = 0.79). There was no evidence of proportional bias in either assessment. There was also evidence of strong convergent validity ($r = 0.68$, $p < 0.05$). Both instruments appear robust, however, the CAMSA has the advantage of a combination of both process and product assessment, reduced time to administer and analyze and higher authenticity, and so may be an attractive alternative to the more traditional forms of FMS assessment in school settings.—*Deakin University HDR HSD Research Grant*

The effects of aquatic exercise on gait and strength in individuals with multiple sclerosis

Lange, Allison M., Smith, Kelsea, Lim, Hyosok, Hurtado, Ileana, Jara, Mai N., Vrongistinos, Konstantinos, Jung, Taeyou, California State University Northridge

Multiple Sclerosis (MS) is a progressive neurodegenerative disease which is associated with various physical, cognitive and emotional impairments. These impairments can limit independence in activities of daily living and decrease the level of physical activity. Aquatic exercise can help people with MS improve their function while enhancing the level of physical activity in an accommodating environment. OBJECTIVE: To investigate the effects of aquatic exercise on gait and strength outcomes in individuals with MS. The study also examined pain and fatigue outcomes after aquatic exercise. METHODS: A total of 20 participants were randomly assigned to either aquatic or control group. The aquatic group participated in 50-minute aquatic training twice a week for 10 weeks while the control group was asked to continue their daily activities as usual. Gait outcomes were assessed by a 3-D motion analysis system and isometric strength of the knee extension/flexion was measured by a computerized dynamometer before and after the 10-week intervention period. Additionally, pain and fatigue were measured by the brief pain inventory (BPI) and modified fatigue impact scale (MFIS). RESULTS: The mixed-model ANOVA showed greater improvements in quadriceps strength, cadence, stride length, walking speed, ankle excursion, ankle peak plantarflexion, pain level and fatigue level of aquatic group participants as compared to the control ($p < .05$ for all). The aquatic group increased muscle strength in quadriceps by 32.60% (from 66.03±14.93 to 87.59 ±15.27). Also, aquatic group showed increases in stride length by 14.03%, walking speed by 21.88% and peak ankle plantarflexion by 71.62% ($p < .05$ for all). CONCLUSION: The results suggest that aquatic exercise can be effective in improving muscle strength in the knee extensors and overall gait performance of individuals with MS. In particular, aquatic exercise appears to help people with MS develop efficient use of ankle motions for walking.

It's about time! Feedback delay, but not feedback type, matters for determining adaptation processes.

Larssen, Beverley C., Hodges, Nicola J., University of British Columbia

Augmented visual feedback can be a rich source of information used to inform corrections of future movements. Adaptation of aiming movements to a visual rotation between a participant's hand and cursor can occur via two possible processes: an implicit process (evidenced by large, unintentional after-effects) or explicit/strategic process (evidenced by long RTs and high inter-trial variability). The type of visual feedback appears to be important for the type of adaptive process; although the specific conditions and reasons are debated. When it is provided online, a more implicit process is engaged, compared to offline (after movement completion), which promotes more explicit processes (e.g., Hinder et al., 2010). Yet, these findings have not always been replicated (e.g., Bernier et al., 2005). Due to discrepancies in findings and possible differences between feedback-delay versus feedback-type, our aim was to isolate what feedback conditions moderate adaptation processes. Participants (n=8/gp) practised in a 30 degree CW rotated environment and then were tested for after-effects in a normal environment. Group 1 (Online) received real-time cursor feedback during the movement. Two groups received feedback immediately after movement completion (Offline_Visual; cursor) or (Offline_#; numeric KR). Group 4 received cursor feedback after a 3 s delay (Offline_Visual+3). All groups adapted to the rotation, however feedback delay modulated implicit adaptation. Regardless of the type (cursor or numeric), or if it was provided online or offline, feedback immediately after movement execution resulted in after-effects (compared to Pre-test performance, ps < 0.05). However, when feedback was delayed by 3 s, no after-effects were shown. These findings confirm that the timing of the feedback is critical for adaptation processes, with a delay hindering implicit adaptation, potentially as a result of the availability

of feedforward information for comparison. Contrary to suggestions by others, implicit adaptation can occur when visual feedback is provided offline or numerically.

Action experience may enhance anticipation skill in soccer penalty kick

Lee, Jung Eun, University of Minnesota; Shim, Jaeho, Baylor University; Yook, Dongwon, Hong, Seog Beom, Yonsei University; Cho, Seong Kwan, Texas A&M International University

Background: Anticipating the ball flight direction is important in fast speed interceptive sport, such as in blocking soccer penalty kicks. Contrary to the traditional view of perceptual familiarity, the common coding theory hypothesizes that representations that occur when one observes another person's action and when one actually performs the action are commensurate. The purpose of this study was to compare the perceptual anticipation skill between a group with greater motor expertise (field players) and a group with perceptual expertise (goal-keepers) in soccer penalty kick task. Methods: A total of 19 collegiate soccer players participated in the study. Ten field players served as the action group while nine goal-keepers served as a perception group. A total of 20 video footage of soccer penalty kicks were created with an occlusion at the point when the non-kicking leg of the model (collegiate field players) was placed on the ground. Participants observed the video clips and judged the direction (right/left) of the ball in writing immediately after the occlusion. The percentage of correct responses was calculated. Results: Independent t-test on the response accuracy between the goal-keepers (perception group) and the field players (action group) showed a significant difference ($t = 3.243$, $df = 17$, $p= .003$), with field players (75.3%) outperforming the goal keepers (59.2%). Discussion: Findings indicate that actual motor experience of soccer kick can be beneficial in perceptual anticipation when observing similar kicks. Therefore, it is possible that practicing actual penalty kicks can enhance the goal-keepers' blocking rate. In future, providing novices two distinct experiences of either perception or action and comparing their direction judgment may shed more insight on the significance of perception and action experience in anticipation.

The effects of autonomous difficulty progression on engagement and learning during a motion-controlled video game task.

Leiker, Amber, Auburn University; Bruzi, Alessandro, Universidade Federal de Lavras; Nelson, Monica, Wegman, Rebecca, Miller, Matthew, Lohse, Keith, Auburn University

Allowing learners control over their practice environments has been shown to augment motor skill learning. It is thought that this learning advantage is due to increased engagement and motivation during practice, but there is little empirical evidence supporting this claim. To address this shortcoming, we had 60 participants play a video game while assigned to either a self-controlled group, in which participants chose the difficulty level of each practice block, or a yoked group, in which practice block difficulty was matched to a self-controlled counterpart. Pre-test performances, engagement via the User Engagement Scale, and intrinsic motivation via the Intrinsic Motivation Inventory (IMI) were measured on the day of practice, while post-test performances under easy, intermediate, and hard difficulty levels were measured 1-week later. There were no group differences in performance on the pre-test or during practice. RM ANCOVA of the retention test, controlling for pre-test, revealed a significant main-effect of group, $F(1,57) = 5.93$, $p = 0.03$, and a group by test difficulty interaction, $F(2,144) = 3.21$, $p = 0.04$, such that the self-controlled group performed better on average, but the group difference was only significant on the intermediate difficulty test. There were no statistically significant differences between groups with respect to survey measures of engagement, but the self-controlled group did report greater intrinsic motivation, $t(58) = 2.61$, $p = 0.01$. Furthermore, exploratory regression analyses found no relationship between affective measures and post-test performance, controlling for pre-test and group. Self-control over the difficulty of practice facilitated learning coincident to increased intrinsic motivation during practice, but did not increase engagement. Furthermore, exploratory regression analyses found no association between engagement or motivation during practice and learning, suggesting that these affective mechanisms are coincident to, but not responsible for, the learning advantage.

Autonomy support enhances performance expectancies, task-focus, and learning: Support for the OPTIMAL theory of motor learning

Lemos, Anielle, Federal University of Pelotas, Brazil; Wulf, Gabriele, University of Nevada, Las Vegas;

Lewthwaite, Rebecca, Rancho Los Amigos National Rehabilitation Center, Downey, CA; University of Southern California; Chiviacowsky, Suzete, Federal University of Pelotas, Brazil

In the OPTIMAL theory of motor learning (Wulf & Lewthwaite, 2016), autonomy support contributes to successful performance and learning by enhancing expectancies (e.g., self-efficacy, positive affect). Enhanced expectancies for future positive experience, in turn, facilitate learning by (a) promoting a focus on the task goal and (b) making dopamine available for memory consolidation. The present study was designed to test expectancy- related predictions. Ten-year old children viewed a video demonstration of a sequence of 5 ballet positions they were asked to learn: Preparatory position, demi plie, tendu with arms and legs in second position, passe with arms in first position, and eleve with feet in first position. In the autonomy- support (AS) group, participants were able to choose additional demonstrations throughout practice, while control (C) group participants were provided with demonstrations based their yoked counterparts' choices. One day after practice, participants performed a retention test. Movement form was rated by two experts. As intra-class correlation was high (ICC = 0.982, $p < .001$), the scores of both raters were averaged. The AS group demonstrated greater performance improvements during practice and enhanced learning relative to the C group. Furthermore, AS participants had higher self-efficacy scores after practice and before retention. The AS group also reported higher positive affect than did the C group at the end of practice. Finally, in response to a question what they thought about while practicing, AS participants' responses were more positive and reflected a task focus, while C group participants' comments tended to be more negative and indicated a greater self-focus. Overall, the present findings demonstrate that learning advantages of autonomy-supportive practice conditions were associated with increases in self-efficacy, positive affect, and task focus, consistent with OPTIMAL theory predictions.

Does vibro-tactile stimulation of the vestibular system influence standing postural control?

Lempke, Nicholas, Ambati, Pradeep, University of Nebraska at Omaha; Janky, Kristen, Boys Town National Research Hospital; Kyvelidou, Anastasia, University of Nebraska at Omaha

The vestibular system functions to preserve posture, equilibrium, and the body's position in space, it also plays an imperative role in managing locomotion and other motions (Watson & Black, 2008). These vestibular signals might be critical for updating whole body representation while one moves in external space (Pfeiffer, 2014). The purpose of this research project was to investigate the potential changes in balance control in healthy young adults when stimulation of the vestibular system occurs via vibro tactors. We hypothesized that the postural sway variability of the participants will decrease significantly when they are administered with vestibular stimulation during the Sensory Organization Test (SOT) compared to the postural sway without vestibular stimulation during SOT. A group of 18 subjects, 11 male and 7 female, between the ages of 19 and 30 participated in the EquiTest system on Neurocom, without and with vestibular stimulation at 3 different various frequencies (74 Hz, 83 Hz, 93Hz). Six conditions were tested, 1) eyes open, fixed surface 2) eyes closed, fixed surface 3) eyes open, surrounding tilting about the medio-lateral axis 4) eyes open, surface tilting about the medio-lateral axis 5) eyes closed, surface tilting about the medio-lateral axis 6) eyes open, surface and surrounding tilting about the medio-lateral axis. We used RMS in the anterior/posterior (AP) and medial/lateral (ML) direction. The RMS of COP in both ML and AP directions were influenced by the frequency of tactor use. RMS AP values decreased as frequency increased and RMS ML values increased as frequency increased. From these results, it can be concluded that vibro-tactile stimulation on the mastoid process did have an effect of standing posture. This effect could be due to perturbing the vestibular system or by stimulating the proprioceptors of the neck. The tactor placement on the left and right mastoid processes could explain the increased RMS values in the ML direction, and the decreased RMS values in the AP direction.

Neuromuscular time-delay and visually-induced dynamic instabilities

Liddy, Joshua J., Purdue University; Chagdes, James R., Miami University; Huber, Jessica E., Zelaznik, Howard N., Rietdyk, Shirley, Raman, Arvind, Haddad, Jeffrey M., Purdue University

Limit cycle oscillations (LCOs) are self-sustained periodic fluctuations that indicate dynamic instability in nonlinear, time-delayed systems such as sensorimotor feedback loops. Mathematical models predict LCOs in postural sway when neuromuscular time-delay and feedback gain is high (Chagdes et al., in press). LCOs have been

observed in the standing posture of various populations known to have longer time-delays (Chagdes et al., in press) including concussed young adults and adults with neuromuscular impairment. However, the relationship between feedback gain and time-delay that leads to these LCOs is unknown. Thus, we examined the relationship between the time-delay of healthy adults and the onset of LCOs under altered visual feedback. Based on the model, we hypothesize that people with longer time-delays will demonstrate LCOs at a lower feedback gain. The neuromuscular time-delay of 10 healthy, young adults was assessed via support surface translations since this assessment is highly correlated with somatosensory evoked potentials (Cameron et al. 2008). Participants then stood in a moving surround (Neurocom Equitest) that was anti- phase coupled to their center-of-pressure (COP) displacements. Feedback was manipulated by altering the magnitude of the visual surround movement (θroom/θsway, range 0-2) to amplify perceived sway (effectively increasing feedback gain). COP trajectories were analyzed using a novel wavelet-based technique to identify LCOs. Postural response latencies ranged from 120-141 ms (131.7 " 6.5 ms) and LCOs were induced in 7 of 10 participants. A weak, negative relationship (r = -0.31) between time- delay and the lowest visual gain that produced LCOs was observed. Thus, postural instabilities were induced in healthy, young adults by increasing perceived sway. The negative relationship between time-delay and LCO onset is in agreement with the predictions of the mathematical model and suggests that the emergence of postural instabilities may be related to increases in time-delay, which are further exacerbated by high feedback gain.

Postural sway inaccuracies using the Wii balance board: A mathematical description

Liddy, Joshua J., Purdue University; Chagdes, James R., Miami University; Arnold, Amanda J., Claxton, Laura J., Haddad, Jeffrey M., Purdue University

The Wii Balance Board (WBB), a portable, low-cost gaming device, accurately captures center-of-pressure (COP) in children, adults, and pathological populations during quiet standing (e.g., Clark et al., 2010; Larsen et al., 2014). However, under certain paradigms, including infant sitting (Arnold et al., in prep), a bias proportional to the magnitude of COP range emerges between the WBB and a standard force plate. Differences in sensor technologies contribute to this bias. The WBB has uniaxial vertical force transducers while force plates typically contain tri-axial strain gauge transducers. The WBB therefore cannot calculate shear forces and must assess COP as the weighted averaged of the vertical forces. Force plates incorporate shear forces in the COP calculation to improve accuracy. In this study, we developed a mathematical model to examine the mechanisms contributing to the aforementioned bias when using the WBB. A single-degree-of-freedom inverted pendulum model was used to represent sitting infant balance on a force plate to allow the evaluation of reaction forces and torques used to calculate COP. All rotation and corrective torque was assumed to occur about the hip joint with the upper body acting as the inverted pendulum. Postural sway magnitude is often below 10 degrees, thus a linearization about the upright position yields similar dynamics as the nonlinear model. Model analysis revealed that the exclusion of shear forces in the COP calculation leads to errors equal to hbody*hplate*a/g where hbody is the distance from the hip joints to the center-of-mass (COM), hplate is height of the force plate, a is the upper body angular acceleration, and g is the gravitational acceleration constant. Thus, as COM acceleration increases differences between the WBB and AMTI emerge. Identifying the mechanisms that underlie these differences may ultimately lead to a corrective technique to improve COP accuracy for the WBB. Additionally, this model predicts that the WBB may be ill-suited to measure COP during tasks or in populations where COM accelerations are large.

Effects of focus of attention on older adults

Lin, Ching-er, National Taichung University of Education

The evidence based studies have demonstrated that adult participants benefit more from external focus than internal focus in motor skill learning. The purpose of this study was to investigate the effects of focus of attention in older adults. Thirty participants (Mage = 70 ± 0.2 years) were randomly assigned to either internal focus or external focus condition. The task required participants to throw darts into the center of a circular target with the dominant arm. The process consisted homogeneousness test, 60 trials in acquisition phase, 10 min immediate retention test, and 24 hours delayed retention test. Dependent variable was the accuracy score of the dart throwing. The accuracy scores of acquisition phase were analyzed in 2 (conditions) × 6 (blocks) mixed-design two-way ANOVA with repeated measure on the blocks. The main effect of blocks, $F(5,140) = 4.55$, $p < .05$, ES = 0.14, power = .97, was significant. The accuracy score was getting higher through the trial blocks. The main effect of conditions, $F(1,140) = 0.019$, p >

.05, and the interaction of conditions and blocks, F (5,140) = 0.848, p > .05, were not significant. Immediate and delayed retention tests were analyzed in 2 (conditions) × 2 (blocks) mixed-design two-way ANOVA with repeated measure on the last factor. The main effect of blocks, F (1, 28) = 9.349, p < .05, ES = 0.25, power = .84, was significant. The main effect of conditions, F (1, 28) = 0.156, p > .05, and the interaction of conditions and blocks, F (1, 28) = 0.877, p > .05, were not significant. The accuracy score of immediate retention test was higher than delayed retention test. Therefore, no significant differences were found between internal and external focus of attention among older adults' darts throwing of performance and learning.

Modifying coordination patterns during reaching using reinforcement

Lin, Tzu-Hsiang, Michigan State University; Denomme, Amber, Siena Heights University; Ranganathan, Rajiv, Michigan State University

Given the number of degrees of freedom in the human body, most tasks can be performed using multiple coordination patterns. In this context, it is critical to understand how we shift participants from one coordination pattern to another when doing the same task. Here we examined if we could modify coordination patterns by using a simple reinforcement scheme wherein participants could not complete the task unless they switched to a new coordination pattern. Healthy college-aged individuals (n = 24) participated in the experiment. Using a motion capture system, we created a virtual reaching task where participants had to move their hand in order to move a screen cursor to different targets. Normally, participants show minimal trunk motion when doing this task - so we used a visual feedback scheme to get participants to adopt a new coordination pattern with greater trunk motion. We created a threshold such that the cursor disappeared during the movement if the trunk motion was below this specified threshold. Participants were not specifically instructed as to what caused the cursor to disappear. In order to compare different ways of introducing the threshold, we split participants to two groups. In the Abrupt group, the threshold was introduced on a single trial, whereas in the Gradual group, the threshold was reduced gradually over trials. All participants performed a total of 420 trials, and we compared the performance in the pre-test and post-test (where no threshold was introduced). Result showed that both groups had more trunk movement during the post-test, indicating that participants altered their coordination pattern. Increase in smoothness measures showed that participants were able to learn how to coordinate the movement of the trunk with the arm. In addition, the Abrupt group tended to show a greater learning compared to the Gradual group. These results demonstrate that it is possible to shift participants to alternative coordination patterns for solving a motor task using simple reinforcement learning.

Influences of prior practice experiences: Movement outcomes, movement dynamics, and learning dynamics

Liu, Yeou-teh, Department of Athletic Performance, National Taiwan Normal University; Chuang, Kuo-Liang, Department of Physical Education, National Taiwan Normal University; Newell, Karl M., Department of Kinesiology, University of Georgia

When a new task is to be learned, the relation between the task dynamics and the intrinsic dynamics of the learner determines the pathway and time scales of learning. Extended practice experience on certain tasks shape the intrinsic dynamics of the individuals that affect the learning process in different levels. Throwing is one of the fundamental movement tasks in our everyday life but also in many competitive sport events. Athletes such as basketball players have to practice particular throwing movements extensively in order to perfect the game performance. How does the particular throwing practice experience affect a novel yet other kind of throwing task performance" 24 college students participated in the learning-to-throw study and 12 of them were Collegiate division A basketball players of Taiwan and the others had no sport training experiences. All the participants practiced 50 trials a day for 3 days. The goal of the task was to throw a ball that was placed in a cup attached to the dominant wrist of the participant to a target area in a distance twice the height of the participant while sitting on a chair. 2-dimensional kinematics of the hip, shoulder, elbow, wrist, and the ball were captured with a high-speed camera and Kwon 2D motion analysis system. Throwing accuracy, ball release kinematics, and the throwing arms' kinematics were used in multivariate statistical analyses. The MANOVA results showed that basketball players were more accurate, had faster ball speed, smaller shoulder and elbow angles at ball release than students. In addition, the results of the discriminant analyses showed different contributing powers from the ball release kinematics and the throwing arms' kinematics in differentiating the hit or missed throws for the 2 groups. Furthermore, the canonical analyses results showed different strategies used by the 2 groups over the 3 days. Our findings show that the prior extensive practice

experience of the basketball players influenced the novel throwing task on all levels of performance, and there is a tight link among these levels.

How movements impact on temporal and spatial representations

Loeffler, Jonna, Raab, Markus, German Sport University Cologne; Canal-Bruland, Rouwen, Vrije Universiteit Amsterdam

Do whole-body movements influence representations of time and space? Lakoff and Johnson's conceptual metaphor theory (1980) and current theories of embodied cognition (e.g., Barsalou, 1999) contend that abstract concepts are grounded in sensorimotor experiences. In keeping with these theoretical views we predicted that the execution of whole-body movements should result in systematic modulations of temporal and spatial representations. To test this, we invited participants to walk forward, backward, or stand still on a treadmill and examined whether walking in either direction changed their responses to ambiguous temporal or spatial questions previously validated in Boroditsky (2000). Results of Experiment 1 revealed that walking forward and backward indeed systematically modulated responses to the temporal question. However, walking forward and backward resulted in answers pointing into the same temporal (i.e., future-oriented) direction. In contrast to Experiment 1, Experiment 2 did showed no effects of movement on answering the ambiguous spatial question. Together, these findings seem to indicate a selective effect of whole-body movements on temporal but not spatial representations.

Neural correlates of attentional focus: A high-resolution fMRI study

Lohse, Keith R., Miller, Matthew W., Grand, Kirk F., Robinson, Jennifer L., Auburn University

Much research has been conducted on behavioral and peripheral consequences of different foci of attention (internal vs. external), but little is known about central mechanisms. The purpose of the present study was to use an attentional focus paradigm with functional magnetic resonance imaging (fMRI). Twelve participants performed a force production task in a 7T fMRI (Siemens Magnetom). Participants squeezed a dynamometer with their dominant right hand under three attentional focus conditions. Force and electromyographic data were recorded using a Biopac MP150. In a control attentional focus condition participants were instructed to meet their target force (30% of their maximal force) cued by a circle; in an external focus condition participants were additionally instructed to focus on the dynamometer and were cued by an image of the dynamometer, whereas in an internal focus condition participants' additional instruction was to focus on the agonist muscles of the forearm and were cued by an image of a clenched fist. Following each trial, participants were asked to judge the accuracy of either the force produced (control/external) or the magnitude of muscle activation (internal). However, participants received no augmented feedback about their accuracy during the experiment. Behaviorally, there were no statistically significant differences in force accuracy between the conditions ($F(2, 22) < 1$). Neurophysiologically, there was greater activation of right dorsolateral prefrontal cortex in the internal condition compared to the external, and right precentral gyrus showed greater activation in the internal condition compared to the control (all maps voxel and cluster thresholded at $p < .05$, multiple comparison corrected). Although the attentional focus conditions were not different in terms of their behavioral outcome, participants were clearly engaging disparate neural networks to produce similar performances. Specifically, the internal focus condition showed increased recruitment of ipsilateral motor cortex and prefrontal regions associated with executive function.—*Auburn University College of Education Seed Grant Program*

Self-selected difficulty, engagement, and intrinsic motivation in an interactive computer game: An exploratory analysis.

Lohse, Keith, Leiker, Amber, Auburn University; Bruzi, Alessandro, Universidade Federal de Lavras; Wegman, Rebecca, Nelson, Monica, Miller, Matthew W., Auburn University

Engagement is one of the key psychological constructs behind "gamification" – the application of traditional game mechanics (e.g., points, badges, and leaderboards) to non-game environments (e.g., STEM education or physical therapy). Previous research suggests that progressive and appropriate challenge is a mechanism to reliably increase engagement. Thus, having control over game difficulty should increase engagement. Sixty participants were randomly assigned to either a self-controlled group, who chose their level of difficulty throughout the game, or a yoked group, who received a matched difficulty progression without choice. Self-control group data were analyzed

to (1) identify when participants decided to change difficulty (either more or less) and (2) explore potential relationships between the difficulty of practice and engagement as well as intrinsic motivation (self-reported at the end of practice.) Linear mixed-effect regression (LMER) was used to analyze participants switching behavior over time. LMERs showed that participants were more likely to change difficulty following high scoring trials, $t = 5.71$, $p < 0.001$, but that this decision was contingent on the difficulty of the specific trial, $t = 5.02$, $p < 0.001$, such that participants' decisions were more performance-based on the hardest trials. Partial correlations controlling for pre-test performance showed that the number of changes in difficulty was positively correlated with overall engagement, $r = 0.43$, $p = 0.02$, intrinsic motivation, $r = 0.42$, $p = 0.02$, and perceived competence, $r = 0.40$, $p = 0.03$. (The average level of difficulty was not correlated with any of these measures.) Although exploratory, these analyses provide support for the largely theoretical conjecture that adaptive difficulty increases engagement with a game environment. Further, participants were objectively "failing" at many of the game objectives, but engagement ratings were quite high and more adjustments in difficulty were associated with higher levels of engagement, intrinsic motivation, and perceived competence.

Foot clearance over real environment obstacles after virtual reality obstacle crossing

LoJacono, Chanel T., Raisbeck, Louisa D., Ross, Scott E., Rhea, Chris K., University of North Carolina at Greensboro

Obstacle crossing is a critical part of safe ambulation. Clinical populations tend to show decreased ability to safely negotiate obstacles within their walking path, as they exhibit low gait adaptability, which can lead to an increased risk of falling or subsequent injury. Training programs to enhance obstacle avoidance strategies in clinical populations have been developed with some success. However, these programs often require physical space and materials that may be unavailable in clinical settings. Virtual reality (VR) training provides a solution to these barriers and allows for a safe and engaging environment to promote motor learning, but only if VR training transfers to the real environment. The purpose of this study was to evaluate toe clearance (TC) and heel clearance (HC) over real environment obstacles after crossing obstacles in VR. Younger healthy adults (n=19, 22.5 " 3.6 yrs) and older healthy adults (n=17, 55.3 " 6.2 yrs) crossed a 10 cm real environment obstacle 10 times (pre-training). Next, a 10 cm virtual obstacle on a projection screen was shown moving toward the participants as they walked on a treadmill. They were asked to step over just as they did in the real environment for a total of 25 trials (5 practice trials and 2 sessions of 10 virtual obstacles each). Participants then crossed the same real environment obstacle 10 more times (post-training). TC and HC were measured with motion capture by determining the vertical distance between the top of the obstacle and the heel for leading limb (HC) and toe for trailing limb (TC). The age (younger/older) " time (pre/post) interaction was not significant for HC ($p=.93$) or TC ($p=.42$). However, a main effect for time was observed for HC, $F(1,34)=7.7$, $p=.009$, and for TC, $F(1,34)=34.1$, $p<.001$. Average HC for all participants increased from 13.6 " 3.7cm in pre-training to 14.4 " 4.3cm in post-training. Average TC increased from 9.6 " 3.9cm to 11.7 " 4.9cm. These results suggest that VR obstacle training may increase foot clearance in the real environment, leading to a lower risk of tripping.

Human odometer on inclined surfaces

Lopez-Felip, Maurici A., Davis, Tehran J., University of Connecticut

Berkeley's premise that distance can be measured by touch suggests that animals' success in navigating the world relies on idiothetic information. To test this hypothesis, recent studies have asked blindfolded actors to walk from a starting location (A) to predetermined ending location (B) (measure phase-M) in a straight line along a flat surface. Participants are then tasked with returning to the starting location (B➔A) by freely blind-walking (report phase-R), where the length walked, the report is taken as an index of perceived distance. In the present study we extend this work, noting that in our everyday activities we are frequently confronted with irregular surfaces, often switching from flat to slope terrains. Using a treadmill, our aim was to investigate the ability of actors to replicate distances under different incline conditions using a treadmill (where incline has an effort on effortful walking). Twenty participants were recruited to walk and report 2 possible M-distances (short: 9m and long: 16m) and the treadmill was either flat (F) (0% grade) or sloped (S) (15% grade) resulting in four possible M-R conditions: F-F, S-S, F-S and S-F. "Results: Participants' reports were normalized for relative error (R-distance/M-distance). These values were submitted to a 2 (short, long) x 2 (M incline) x 2 (R incline) ANOVA; revealing a significant two-way

interaction between distance and report slope [F(1,18) = 5.36, p = .033]. In all conditions participants tended to overestimate M-distance. However, depending on M- distance, increasing the incline had opposite effects: for the shorter M-distance (9m), reports were greater in the slope return condition compared to the flat return condition; for the longer M-distance (16m) reports were decreased in the slope condition. These results suggest that the relative effort involved in the return (increasing slope) may have an impact on perceived distance, but it is contingent on the distance traversed. Implications for current literature and the impact of changes in gait dynamics will be discussed.

Using feedback enhanced visual metronomes to manipulate gait dynamics

Macpherson, Ryan P., Raisbeck, Louisa D., Etnier, Jennifer L., Rhea, Christopher K., University of North Carolina in Greensboro

Gait dysfunction is correlated with a weakening of dynamic fractal patterns observed in stride times and it is believed that strengthening fractal patterns may enhance gait ability. Fractal patterns in gait are strengthened by synchronizing to a fractal metronome stimulus, and this stronger pattern is retained immediately after training. However, the fractal gait patterns were not as strong as prescribed by the metronome, potentially due to the nature of the stimulus (i.e., the metronome had no user interaction). Thus, adding real-time feedback about the accuracy of synchrony with the stimulus may be beneficial in strengthening fractal gait patterns. Healthy young adults (n=13, 22.8"3.0 yrs) performed two 30-minute treadmill walks on two separate days. On each day, participants completed three 10-minute phases: (1) pre-sync (walking with no metronome), (2) sync [synchronizing to flashing footprints presented on a screen in front of the treadmill that prescribed the desired fractal timing pattern with either feedback (FB) or no feedback (NFB)], and (3) post-sync (walking with no metronome to examine retention). On the FB day, the footprints turned green if the participants were at heel contact when the footprint appeared or red if the participants were not at heel contact when the footprint appeared. On the NFB day, all footprints were brown regardless of the participant's ability to accurately synchronize. Fractal patterns in stride time were quantified using detrended fluctuation analysis. When provided with FB, participants successfully synchronized with the metronome 53.3"15.4% of the time, but there was no correlation between increased synchronization and stronger fractal gait patterns, r(11)=.30, p=.32. A main effect for phase was observed, F(2,24)=9.54, p=.001, but not for feedback (p=.104). The feedback (with/without) " phase (pre/sync/post) interaction was not significant (p=.41). The results show that the addition of feedback does not lead to stronger fractal patterns relative to the non- feedback condition, nor does it enhance retention.

Cricket batsmen may have been batting back-to-front since the invention of the game

Mann, David L., VU Amsterdam; Allen, Peter M., Anglia Ruskin University; Runswick, Oliver R., St Mary's University

When first learning to bimanually use a tool to strike a target (e.g., when hitting a golf or cricket ball), most people assume a stance that is dictated by their dominant hand. By convention, this means that a "right-handed" or "left-handed" stance is adopted, generally placing the dominant hand closer to the striking end of the tool. Yet it is unclear why this is the case and whether doing so provides the best chance of acquiring skill. The aim of this study was to investigate whether the "conventional" stance provides the best means of achieving expertise in bimanual hitting. This was done in the sport of cricket by directly testing the batting stance, plus hand and eye dominance of 43 professional (international/first-class) and 93 novice (<5 years participation) batsmen. The results revealed a stunning advantage for batsmen who defied convention and used the opposite ("reversed") stance to that expected based on their handedness (i.e., by those who are right-hand dominant but adopt a left-handed batting stance or vice-versa). Professional batsmen were 7.1 times more likely to adopt a reversed stance than novice batsmen (40 vs. 9% of batsmen; $\chi2(1) = 19.2$, $p < .0001$), independent of whether batting right or left-handed. The position of the dominant eye (at the front or back of the stance) played no role in the effect ($p = .60$), suggesting that the reversed-stance advantage is underpinned by the dominant hand being further from (rather than closer to) the striking end of the bat. Findings were supported by additional analysis showing that almost one-third of the 100 highest- ranked modern-day international batters adopt a reversed stance (OR = 4.5 compared to novices; $p < .001$). The findings imply that batsmen who adopt a conventional stance may unintentionally be batting "back- to-front" as they have a considerable disadvantage in achieving expertise. Moreover, findings will be presented to suggest that the results

could generalise more widely to question the way that other bimanual sporting actions are taught and performed (e.g., golf and baseball batting).

Ability to maintain a 0.22 m/sec gait speed as directed by an auditory metronome in adults

McCutchan, Stacey, Christoph, Brady, McDaniel, Samie, Looper, Julia, University of Puget Sound

Auditory cuing has been found to successfully increase cadence, velocity, and step length in adult populations yet training a decreased gait speed has not been researched. The purpose of this study is to determine whether healthy adults can maintain a steady, slowed gait speed after a seven-day training period when guided by an auditory metronome. Twenty 18-45 year olds were recruited. The cadence of each participant was determined as they walked at 0.22m/sec on a treadmill and a metronome was set to this cadence. Subjects then walked over a GaitRite mat to measured cadence (cad) and velocity (vel) with metronome guidance (M) and without metronome guidance (NM). This was completed before and after a seven-day training period. The training period consisted of walking to the beat of a metronome pre-set to each subject's cadence for 10 minutes/day over five of seven days. A 2(condition)x2(visit) repeated measures ANOVA was performed for both cad and vel. The average cad in steps/min at visit one was 35.3("10.2) and 36.3("5.2) and at visit two was 30.6("7.6) and 36.98("5.5) (NM and M, respectively). The average vel in m/sec at visit one was 0.25("0.07) and 0.27("0.05) and at visit two was 0.23("0.07) and 0.28("0.06) (NM and M, respectively). There was no significant difference in pre and post-test cad (P=0.41) or vel (P=0.47). Cad and vel were significantly higher with the M than with NM (P=0.004 and P=0.001, respectively). An interaction effect showed that cad did not significantly change between visit one and visit two with M, however cad did significantly decrease between visits with NM (P=0.02). Lastly, vel at visit two was not significantly different than the desired speed of 0.22 m/sec in the NM condition (P=0.56), however was significantly different in the M condition (P=0.001). In conclusion, metronome use slowed gait to a specific speed only after the auditory cue is removed. Constant auditory cueing is helpful in maintaining a consistent cad and vel, however metronome guidance alone is not effective for producing a single desired gait speed.

Motivation and motor-preparatory brain activity independently affect response time

Meadows, Caroline C., Auburn University; Gable, Philip A., University of Alabama; Lohse, Keith R., Miller, Matthew W., Auburn University

Motivation drives individuals to obtain goals, with higher motivation linked to greater goal pursuit. Thus, motivation typically exhibits a positive relationship with performance. When performance involves a motor task, it is possible high motivation enhances motor preparatory brain activity in order to facilitate muscle activation necessary for performance. Indeed, it is possible motor preparatory brain activity mediates the relationship between motivation and muscle activation. The present experiment tested this hypothesis by modulating participants' (N = 20) motivation with monetary incentives, indexing their motor preparatory brain activity with electroencephalography, and measuring the speed of their muscle activation with electromyography, during 168 trials of a response time task. Each trial began with the presentation of a monetary incentive ranging in value from $0.00 to $4.96. Next, a "Go" signal (an auditory tone) was presented, which indicated participants should use their dominant right-hand to squeeze a dynamometer as quickly as possible. Participants were told quick responses to the tone increased the likelihood they would earn the incentive at stake. Each trial concluded with augmented feedback indicating whether participants earned the incentive. Motor preparatory brain activity during the 3-s preceding the "Go" signal was indexed by suppression of the beta frequency bandwidth over contralateral motor cortex. The speed of muscle activation was determined by measuring the time between the "Go" signal and activation of the agonist muscles of the forearm. Contrary to the hypothesis, we observed monetary incentive reliably predicted muscle activation speed when controlling for beta suppression, which independently predicted muscle activation speed. Thus, it appears motivation and cerebral cortical motor preparatory brain activity facilitate muscle activation independent of one another. One possibility is that motivation affects muscle activation downstream of cerebral cortex by activating ventral striatum, which connects to motor circuits.

Spatial Accuracy in Underhand and Overhand Throws
Meyer, Ben, Shippensburg University

Accurate throwing is an important skill for athletes in a variety of sports. Numerous studies have examined the variables that affect the final accuracy of a throw. Schneider & Williams (2010) used a basketball free throw shooting task to compare underhand and overhand shooting techniques, and they found a positive correlation between the two techniques. Venkadesan & Mahadevan (2010) found that using an underarm throw to a target leads to an undershoot, but an overarm throw does not. The purpose of this study was to examine the differences in spatial accuracy between underhand and overhand throwing techniques. Undergraduate students (21 male, 11 female; age = 20 " 1 yr) volunteered to participate in the study. Data were collected using a repeated-measures, counterbalanced design. Each participant performed 30 underhand and 30 overhand throws toward a target using a Koosh ball. Throwing accuracy (PTS) and variability (VE) were computed from the performance data. Participants stood with their feet behind a line that was located 6 m from the target and performed all throws with their dominant hand. The accuracy of underhand throws (62.5 points/throw) was significantly smaller ($p < 0.05$) than the overhand throws (65.1 points/throw). Participants improved by 0.89 points/block in the overhand condition and by 0.77 points/block in the underhand condition. The variability of underhand throws (14.5 points/throw) was not significantly different ($p > 0.05$) than the overhand throws (15.1 points/throw). Participants lowered their VE by 0.46 points/block in the overhand condition and by 0.18 points/block in the underhand condition. The correlations between underhand and overhand throws were moderately positive for both PTS and VE (Pearson $r = 0.76$ and $r = 0.69$, respectively). Future research should utilize a larger number of trial blocks in order to determine how long it takes to reach a performance plateau during underhand and overhand throws.

Examining impulse-variability theory and the speed-accuracy trade-off in overarm throwing performances in children
Molina, Sergio L., Missouri Western State University; Stodden, David F., University of South Carolina

The purpose of this study was to examine variability in throwing speed and spatial error (i.e., accuracy) at various percentages of maximum throwing speed in children to test the prediction of an inverted-U function of force output (i.e., Impulse-Variability Theory) and the applicability of the speed-accuracy trade-off Forty-five 9-11 year-old children (mean age= 10.7 years; 21 girls) threw hand sized balls for maximum throwing speed, measured using a radar gun (Stalker, Inc.), and then familiarized with the testing protocol during session one of testing. During session two of testing, participants performed 10 throwing trials at each target speed condition (45%, 65%, 85%, and 100%) in random order across five consecutive eight trial blocks. Children threw at a target on a wall located 3.05 m away and 1.5m off the ground. Participants were instructed to throw at specified percentages of maximum speed and hit the target. Throwing speed variable error and three measures of spatial accuracy were analyzed using repeated measures ANOVA with built-in polynomial contrasts. Results indicated there were no statistically significant differences in variable error across the target conditions ($p=0.72$), failing to support the inverted-U hypothesis. Results for spatial accuracy indicated there were no statistically significant differences with MRE ($p=0.18$), CE ($p=0.13$), and BVE ($p=0.08$) also failing to support the speed-accuracy trade-off in overarm throwing. These data support other recent studies (Chappell et al., in press; Urbin et al., 2012; & van den Tillaar and Ettema, 2006) indicating that variability and accuracy of overarm throwing performance in children may not follow the general principles of impulse-variability theory (i.e., inverted-U function) or a speed-accuracy trade-off. As neither throwing performance variability nor accuracy changed across percentages of maximum speed in this sample of children as well as in adults, current policy and practice of physical educators and other professionals related to instructional emphases may need to be re-evaluated.

Redefining the movement imagery questionnaire for rehabilitation-second edition (MIQ-RS)
Monsma, Eva V., Brian, Ali, University of South Carolina; Seiler, Brian D., Charleston Southern; Newman-Norlund, Roger D., University of South Carolina; Hall, Craig R., Western Ontario

This study expanded the visual scale of the Movement Imagery Questionnaire adapted for rehabilitation by assessing both INTERNAL and EXTERNAL visual perspectives. This questionnaire includes original MIQ items and others reflective of Activities of Daily Living. Healthy female participants (N=205) completed the MIQ-RS and two other

imagery ability questionnaires that assess abilities from these perspectives and KINESTHETIC imagery ability. Alpha coefficients and within-scale Spearman correlations for INTERNAL (α = .93; r=.45,.72), EXTERNAL (α = .88;.59,.75) and KINESTHETIC (α = .90;.71-.77) abilities indicated items were internally consistent and established convergent validity, respectively. Results of the confirmatory factor analysis indicated the three factor model represented a good fit to the data (chi square=333, p<.001, RMSEA=.06[90% confidence interval=.05-.07]). Examination of the standardized residuals and the modification indexes in the factor loading matrix showed evidence of a three factor model. This not only redefines the MIR-RS by scales represented but we offer a redefinition of its name to be the Movement Imagery Questionnaire for Rehabilitation Settings (MIQ-RS2). Further analysis of gender invariance and the fidelity of the seven movements through multi- trait, multi-method confirmatory factor analysis are recommended.

Ratio of social characteristics affects motor joint action performance

Mukai, Kae, Tsutsui, Seijiro, Aichi University of Education

We are involved with others in daily life. The involvement with others is especially important in team or pair sport situations. In the team or pair sport situations, pair composed from high motor ability members does not always show high pair performance. What factors are related with the high pair performance" Schmidt et al. (1994) showed that both social and motor ability of members are related. However, their task was to keep innate attractor patterns, which are in-phase or anti- phase. Coordination patterns learned by motor learning are not employed. In the coordination patterns, the effects of both social and motor ability of members may be different from the previous study, which employed innate attractor patterns because members need to predict movement with others. Therefore, social ability may be more important than innate attractor patterns. Twenty-four subjects were randomly paired and performed interpersonal joint action task which produce 90" relative phase by two people. Autism-Spectrum Quotient was used to investigate social characteristic. Both pairs composed from two high social characteristic people and pairs composed from two low social characteristic people slowed poor performance. Pairs composed from a high social characteristic person and a low social characteristic person slowed good performance. The high ratio pairs of social characteristics (high/low) showed high performance than low ratio of social characteristics (high/high or low/low). Further motor ability didn't affect joint action performance in the coordination task. Therefore the ratio of social characteristics affects motor joint action performance.

The effect of sequencing information on anticipation

Murphy, Colm P., Brunel University London; Jackson, Robin C., Loughborough University; Williams, A.Mark, Brunel University London

While historically most researchers focusing on anticipation have examined the importance of postural cue utilization, recently it has been reported that elite tennis players can use contextual information such as court positioning and shot sequencing to anticipate effectively in the absence of postural cues. However, the extent to which sequencing information affects anticipation accuracy in high- and low-skilled performers has not yet been explored in a controlled experimental setting. We examined the effect of increasing amounts of sequencing information on anticipation judgment accuracy in tennis. Three experienced tennis coaches identified rallies in which the sequence of shots played was important for anticipating the shot outcome of an opponent. We presented high- (n = 12) and low-skilled (n = 12) tennis players with 23 shots, occluded at the moment of an opponent's racket-ball contact. These clips were edited to display one, three or five shots in the preceding sequence, exposing participants to varying amounts of sequencing information prior to the same occluded shot. Sequences, which were generated from actual match rallies, were presented as animations such that instead of seeing players' bodies (and the associated postural cues) participants saw two cylinders moving around the court. High-skilled participants were significantly more accurate in making anticipation judgments compared with their less-skilled counterparts ($p < .05$). A main effect of Sequence Length was observed for directional judgments ($p < .05$). Moreover, high- skilled participants were more accurate in their directional judgments on long (M = 76.09%, SE = 2.36%) compared with short trials (M = 68.12%, SE = 1.64%; $p < .05$), whereas low-skilled participants did not differ in accuracy across conditions (M = 69.20%, SE = 2.08% vs. M = 67.03%, SE = 3.10%; $p > .05$). Sequencing information can be used to positively inform anticipation judgments and high-skilled performers appear to be able to use this information more effectively than less-skilled performers.

Changes in cognitive demand, impact forces and knee joint loading to reduce risk factors associated with tibial stress fractures in response to in-field gait retraining

Murray, Nicholas, Willy, Richard, Whittier, Tyler, Willson, John, Meardon, Stacey, East Carolina University

High impact forces and knee joint loading during running have been associated with both anterior knee pain and tibial stress fractures. Previous research during a single evaluation session has demonstrated that small increases in a running step rate (steps per minute) will decrease knee joint loading and impact forces during running. However, no research has been done to determine if runners can maintain the new running pattern especially outside the laboratory. Thus, it is unknown if runners are able to maintain a retrained running gait pattern in the field. In addition, it is unclear the increased cognitive demand of gait retraining. The primary purpose is to determine, if field-based gait retraining is effective in reducing cognitive demand as measured through EEG and promotes positive transfer of learning. Our hypothesis is that in-field gait retraining effectively reduces the faulty mechanics associated with tibial stress fractures without increasing cognitive workload following learning. Runners with a history of tibial injury completed a gait retraining protocol which included a baseline run on an instrumented treadmill to establish original gait pattern, a retraining feedback phase in which participants increased their step rate by 10%, 30 days of running with terminal self-selected feedback, and re- assessment following the completion of the retraining protocol. Results demonstrated an increase in cognitive demand based on an increase power in the beta bandwidth, increased theta activity at frontal sites and suppression of alpha activity during initial retraining with a corresponding decrease in EEG indicators of cognitive demand following learning ($p < .01$). Furthermore, increasing step rate reduced high impact forces and knee joint loading during running following retraining. Overall, the results demonstrated the use of EEG as an effective tool to measure cognitive demand during running and the effectiveness of in-field retraining to reduce high impact forces and knee joint loading.

Examining supine-to-stand as a measure of functional motor competence and health in children

Nesbitt, Danielle R., University of South Carolina; Molina, Sergio L., Missouri Western State University; Stodden, David F., University of South Carolina

A child's ability to rise from the floor to a standing position (i.e., supine-to-stand; STS) is seen as a developmental milestone in their physical independence. It also is suggested to be an important primer for the development of other fundamental locomotor/object control skills and is associated with functional capacity in later life. As there are limited assessments that would have the capability to capture global functional capacity (i.e., physical fitness) and development (i.e., motor competence) across the lifespan, the potential predictive utility of this movement skill may be of great value. This study examined associations among measures of STS (i.e,. time to stand and component developmental sequences) with measures of motor competence (hop speed and distance, kicking and throwing speed, and standing long jump distance) and health-related fitness (PACER, push-ups and curl-ups) in late childhood. A convenient sample of 74 (boys= 29) 9-11 year-old children participated in the study. Children's STS variables (time and modal component developmental sequences), MC, and fitness variables were measured and correlated using either Pearson (continuous data) or Spearman (ordinal data) bivariate correlations. Data demonstrated moderate correlations between STS component levels (upper extremity and axial components) and STS time with hopping measures and standing long jump distance ($r=.29-.51$, $p < .01$), as well as and PACER and push-ups ($r=.48-.52$, $p < .01$). Findings provide initial evidence that indicates STS may be an important assessment of functional motor competence, specifically for locomotor skills and aspects of health-related fitness in children. Future research should assess the viability of STS as an important predictor of motor competence and health-related variables (i.e., functional motor competence) across the lifespan.

Sleep spindle density and gross motor sequence learning

Nopper, Isabella, Catholic University of Eichstaett-Ingolstadt; Krewer, Carmen, Schoen Klinik Bad Aibling; Weber, Frederik, University of Tuebingen; Brunner, Hans, Schoen Klinik Bad Aibling; Blischke, Klaus, Saarland University

The sleep spindle is an event in the electroencephalogram (EEG). Spindle parameters have been shown to be altered in sleep following new learning and to be correlated with overnight performance improvements. We tested the notion of sleep spindle density being functionally related to motor memory enhancement. To this end 13 healthy right-handed subjects (25.6 " 6 years; 5 f) spent three consecutive nights in the sleep lab. During each night

polysomnographic data was recorded. On the two evenings following an adaptation night participants with their non-dominant limb either performed a ten-element arm movement sequence (10 blocks of 10 trials) or an equivalent number of movements without any memory requirements. Order of experimental nights was randomized between subjects. Participants were asked to produce the sequence as fast and with as few errors as possible, and were retested the morning following initial practice (3 blocks of 10 trials). Dependent behavioral variables were number of erroneous sequences (ES) and total sequence execution time (TET; correct sequences only), averaged per subject and trial block. Error rate dropped to less than 2 ES during the first 4 practice blocks, $p = .002$, eta^2 = .366, and remained unchanged from thereon, $p = .964$. TET significantly decreased (i.e. execution speed increased) from start (block 1 - 3) to end of practice (block 8 - 10), $p < .001$, eta^2 = .957, and once more from end of practice to retention next morning, $p = .039$, eta^2 = .309 (offline learning). To date EEG data have been assessed only for 6 subjects. The complete polysomnographic data analysis will be presented at the conference. In those 6 participants mentioned, total sleep duration and relation of sleep stages did not differ between experimental nights. When spindle density in the non-learning hemisphere at electrode C3 was subtracted from that in the learning hemisphere at electrode site C4, for the night following sequence acquisition, a strong correlation with offline memory enhancement (decrease in sequence execution time) was revealed ($r = .515$).

The effects of pressure on target distance and size perception during a throwing task

Ogasa, Kisho, Nakamoto, Hiroki, Mori, Shiro, National Institute of Fitness and Sports in Kanoya

In high-pressured sports competition, perceptual distortion is often reported by athletes. Recent evidence has revealed that perceptual distortion for the distance and size of task-related objects is caused by an interpretation of performance outcomes (e.g., Witt & Dorsh, 2009). Namely, perceptual distortion may be induced only after performance, and evidence suggests that performance decrement under pressure is not associated with perceptual distortion. However, research in other domains has shown that a change in perceived task difficulty causes perceptual distortion (Bhalla & Profitt, 1999). Studies have investigated the effects of pressure and have shown that pressure can induce a subjective change in difficulty such as decreased confidence (Woodman & Hardy, 2003). Therefore, pressure may induce perceptual distortion before performance and such distortion may be related to performance decrement under pressure. Consequently, this study clarified whether perceptual distortion was caused by a change in subjective difficulty that occurred due to pressure before performance. Seven participants were required to throw a ball aiming for a circular target and to estimate their subjective feeling about the target size and distance before throwing. After throwing the ball, visual information was occluded by a shutter goggle in order to remove the possibility that the performance outcome influenced the participants' subjective perception. These tasks were conducted under both non-pressure and pressure conditions. Results revealed that subjective difficulty did not differ between pressure conditions. However, the perception of distance in the pressure condition tended to be longer than that of the non-pressure condition [$F (1, 6) = 4.93$, $p = .068$]. These results suggest that distance and size perception were not affected by subjective difficulty, and only distance perception was affected by pressure. That is, perceptual distortion was caused by psychological pressure before performance, and it may be related to performance decrement under pressure.

Role of visuospatial processes during observational practice: Emergence of the view-dependent and view-independents neural dynamics

Oh, Hyuk, University of Maryland-College Park; Braun, Allen R., National Institutes of Health - NIDCD; Reggia, James A., Gentili, Rodolphe J., University of Maryland-College Park

A possible approach that can contribute to learning of new motor skills is observational practice (or imitation learning), which is defined as situations where individuals learn a new movement by first observing a demonstrator physically execute that movement (i.e., action observation) and then try to imitate this novel action that was just observed (i.e., action execution). In support of this notion, it was found that the fronto-parietal mirror-neuron system (MNS) is activated during both action observation and execution, while also contributing to encoding new sensorimotor representations acquired via imitation learning. Interestingly, while humans can observe and imitate an action independently of the perspective from which that action was observed, only a few MNS studies have examined the corresponding visuospatial mechanisms. We recently proposed a fronto-parietal network model of the MNS that, when combined with a parietal visuospatial network, can acquire via imitation learning view-independent

representations of actions demonstrated by others from various perspectives. Two critical limitations of this model were that no view-dependent representations were considered and the model validation did not examine its neural dynamics. Thus, we have now extended our fronto-parietal model to include the middle temporal region and modified its overall connectivity to examine both view-dependent and view-independent representations. Besides the simulated kinematics, synthetic fMRI data was generated to assess the neural dynamics of our model. The results reveal that our fronto-parietal model successfully learned arm movements via imitation learning independently of the perspective from which the actions were observed, while reproducing the view-independent and view-dependent neural dynamics seen in earlier neurophysiological studies. This work contributes to informing human motor learning mechanisms by improving our understanding of the role of visuospatial processes during observational practice.

A criterion validation of objective measures of technical skill proficiency in medical education: A comparison of two motion-capture devices

Ohson, Simran, Garcia, Daniel; Grierson, Lawrence; McMaster University

New approaches to technical skill training in medical education utilize competency-based assessment frameworks. The time consuming and subjective nature of these assessments can place a massive burden on curriculum developers. One possible solution is the replacement of human observation with computerized motion tracking devices. However, these devices must demonstrate their reliability and validity to justify their use in imperative decisions about competency. The Imperial College Surgical Assessment Device (ICSAD) is a prevalent tool that provides metrics regarding the efficiency of movements. It is used to judge expert surgical skill, which is determined by the absolute distance the surgeon's hands travel and the total number of discrete movements they make during an operation. However, to date analysis of the ICSAD assessment metrics have been limited to construct and concurrent validations. In this study, we compare the ICSAD against a criterion standard of motion analysis: the VICON motion-capture system. We compared both devices' accuracy in measuring motions with known "total distance" and "number of movement" characteristics at two velocity thresholds for new movement determination mentioned regularly in the medical education literature: 7.4 mm/sec and 15mm/sec. Our analyses revealed that the ICSAD provides appropriate measurements for total path length ($p < 0.001$) but provides significantly inaccurate measures of the total number of movements performed at the lower velocity threshold ($p < 0.0001$). This research helps us understand how objective motion capture systems may be used to improve methods of competency assessment in medical technical skill education, and leads to new questions about how kinesiology experts may make meaningful contributions to the assessment of physician expertise.

Doubts about the relationship between perceived competency, success and enhanced motor learning

Ong, Nicole T., Brewer, Emily E., University of British Columbia; Hodges, Nicola J., University of British Columbia

Recent studies have shown that feedback or goal manipulations that increase perceptions of success and perceived competency enhance motor learning (e.g., Palmer et al., 2016; Wulf & Lewthwaite, 2010). Yet, in a dart-throwing study (Ong et al., 2015a), perceived success during practice (large target) was transient and did not impact long term retention. Moreover, manipulations to feedback based on easy or difficult criteria, failed to influence learning in a balance task (Ong et al., 2015b). In the study reported here, we attempted to replicate Lewthwaite & Wulf (2010), providing positive comparative feedback in a balance task. Two groups (n=10/gp) practised balancing on a raised platform. On Day 1, the Control group received veridical error (RMSE) feedback only, while a "Positive" group received RMSE and false positive quantitative feedback, indicating they were performing better than average on every trial (t=7). On Day 2, both groups performed 7 retention trials, 1 secondary task trial and 1 transfer (weighted) trial with no feedback. After practice, the groups differed on reported perceived competency at the task, but not on a rating of how successful they felt. There were no group differences in overall RMSE. To more directly influence perceptions of success, we tested a third, Negative group (n=11) that received only qualitative comparative feedback that they were worse than average during practice. Although the Negative group reported lower perceived competency, task interest/enjoyment, intrinsic motivation and preference for comparative feedback when compared to the Control group, there were again no behavioural differences in performance and learning. These findings, together with our previous work, indicate that psychological impacts of perceived success and perceived competency may be less robust than recently reported. It is possible that group differences are a result of

experimenter-subject artifacts where positive/success groups have different quality interactions with the experimenter, which may impact performance and learning. (Funded by NSERC)

Effects of Parkinson's disease on spatial control in bimanual coordination

Pan, Zhujun, Mississippi State University; Van Gemmert, Arend W. A., Louisiana State University

Research has shown that individuals with Parkinson's disease (PD) show timing deficits in the control of asymmetric bimanual movements. They show a strong tendency (stronger than healthy older adults (OA) to shift to a symmetric coordination pattern. The origin for this stronger tendency is likely that the supplementary motor cortex (SMA) plays a critical role in controlling bimanual coordination, and that proper basal ganglia functioning has been associated with accurate SMA functioning. Therefore, it is not surprising that individuals with deteriorated basal ganglia function, such as PD patients, demonstrate bimanual coordination difficulties when asked to perform an asymmetric coordination pattern. Most studies investigating the impact of PD on bimanual coordination focused on the timing accuracy of asymmetric patterns. Spatial accuracy has received much less attention. As temporal and spatial interference in bimanual coordination tasks have a different origin, the present study investigated whether PD impacts asymmetric spatial patterns in a bimanual coordination task. Sixteen OA and 16 individuals with PD (all participants were right hand dominant) drew simultaneously two lines with both hands with varied movement amplitudes (3 and 6 cm) and/or directions (horizontal and vertical). The dependent variables were amplitude error of the line drawn with the right hand (A-error-R), amplitude error of the line drawn with the left hand (A-error-L), directional error of the line drawn with the right hand (D-error-R) and directional error of the line drawn with the left hand (D-error-L). The results showed similar performance in amplitude accuracy between individuals with PD and healthy OA. However, individuals with PD showed reduced directional accuracy on the dominant side when compared to healthy older controls. The results suggest that although the basal ganglia is important for temporal control in bimanual coordination, spatial control of bimanual coordination might be less dependent on basal ganglia functioning.

Learning and transfer of a 1:2 continuous coordination pattern

Panzer, Stephan, Inst of Sport Science; Vieluf, Solveig, Aix-Marseille Universite; Shea, Charles H., Texas A&M University

Recent research demonstrated that after only 10 trials of practice participants can effectively transfer between different multi-frequency patterns 5:3 to a 4:3 pattern without prior practice on the transfer task (Kovacs et al., 2010). In the present experiment practice was extended and we tested transfer performance when the start phase offset of a 1:2 coordination task was altered by 180 deg. That is the start position was changed from 0 to 180 deg or from 180 to 0 deg. Changing the start position required performers start with a homologous muscle activation (0 deg) or non-homologous muscle actions pattern (180 deg) in each cycle. By starting with a non-homologous pattern, the amount of possible distortions (both wrists were in the opposite direction or both limbs moving in the opposite direction) in a cycle increased. Dominant right handed participants (N=20) were randomly assigned to one of two start conditions: one group practiced the 0" 1:2 pattern and then transfer to the 180 deg 1:2 pattern, and the other group performed first the 180 deg 1:2 pattern and then transferred to the 0 deg 1:2. Participants were instructed to perform the task flexing and extending their wrists. All participants had to perform 40 trials (30 s trial) during acquisition. After a rest interval (~10 min) a retention and transfer test were administered. Lissajous feedback was provided during all tests. The data indicated remarkably effective performance (cycle frequency ratio or relative phase slope) for the two groups in the retention and the transfer tests. However, cycle duration increased and harmonicity deteriorated for both groups when they had to transfer to the not practiced pattern. Analysis of the kinematics showed that the left wrist motion was more disrupted when participants had to transfer to the unpracticed pattern. In sum, the distortions in the slower left wrist motion seems to be attributed to the faster right wrist motion regardless of which phase offset the participants practiced the 1:2 multi frequency pattern.

Moving the dominant or the non-dominant wrist faster by different start positions in a bimanual coordination task

Panzer, Stephan, Massing, Matthias, Inst of Sport Science; Kennedy, Deanna, Shea, Charles H., Texas A&M University

An experiment by Kennedy and colleagues (2015) demonstrated that in dominant right handers hesitations in a 1:2 or 2:1 bimanual force coordination task occurred in the limb which had to produce half of the force compared to the contralateral limb. The present experiment was designed to replicate these findings in a dynamic 1:2 or 2:1 multi frequency task where performers had to move their wrists and to determine the influence when the start position was changed from 0 deg to 180 deg or from 180 deg to 0 deg. Changing the start position required performers to start each cycle of the movement pattern with homologous muscle activation (0 deg) or non-homologous pattern (180 deg). By starting from a non-homologous pattern, the amount of possible distortions (both wrists were in the opposite direction or both limbs moving in the opposite direction) in a cycle increased. In a within subject design, participants were required to perform a 2:1-0 deg, a 2:1-180 deg, an 1:2-0 deg, and an 1:2-180 deg (order counterbalanced) coordination pattern using Lissajous feedback (10 practice trials and 3 test trials in each condition). The harmonicity value was calculated to quantify the distortions in the trial-time series. The analysis demonstrated that regardless of the different start positions and regardless of whether the left or right wrist was moving faster, harmonicity was lower in the slower moving wrist than in the faster moving wrist. As in the Kennedy et al. (2015) experiment, the muscle activation pattern of the faster moving wrist appeared to influence the movements of the slower moving wrist. The present results extend the previous findings to a dynamical coordination task. However, it appears that the Lissajous display minimized the effect of the different start positions, and allowed participants to produce relatively stable coordination patterns in each of the conditions.

Observational learning and the role of eye movements

Panzer, Stephan, Inst of Sport Science; Blandin, Yannick, University of Poitiers; Massing, Matthias, Saarland University

An experiment was conducted to determine the role of eye-movements in the development of visual-spatial or motor movement codes. The task was to observe a learning model performing a 1300 ms spatial-temporal pattern of elbow flexions and extensions. During the observation phase participants were randomly assigned to one of two groups: a group that was permitted to use eye movements (FREE) and another group that was instructed to fixate a marker during acquisition (FIX). A retention test and two inter-manual transfer tests were used to assess learning and movement codes. A mirror transfer test required the same pattern of muscle activation and limb joint angles, and a non-mirror transfer test reinstated the visual-spatial pattern of the sequence. At the retention and transfer tests participants had to perform the task physically. Compared to the FIX group the results indicated a lower RMS error for participants of the FREE group during the retention and the two transfer tests. However, the FREE group demonstrated a performance advantage in the non-mirror test compared to the mirror test. The FIX group showed no transfer advantages. These results demonstrate that codes based on visual-spatial coordinates can be developed for simple rapid movement sequences when participants are instructed to observe and permitted to use eye-movements. However, the instruction to fixate limits the system to the development of effective codes for sequence production. This finding is consistent with previous research (Massing, Blandin & Panzer, 2016) and suggests that eye movements play an important role in observational learning and the development of a visual-spatial coordinate system.

Pointing movements and visual illusion: van Donkelaar (1999) revisited

Panzer, Stephan, Inst of Sport Science; Leinen, Peter, Saarland University

Whether or not visual illusions affect the motor system is still under debate in the perception-action literature. In a recent experiment van Donkelaar (1999) used pointing movements and demonstrated that visual illusion influenced the perceived target. Subsequent motor performance was deteriorated when the target was perceived as perceptually smaller. Unfortunately he did not systematically control movement difficulty to disentangle perception and action. A pointing task was used to investigate the influence of visual illusion on the perception-action coupling. To dissociate perception and action processes a size contrast illusion (perception; Ebbinghaus-Titchener-Illusion) and the idea of Fitts' Law was used (action). Fitts' Law predicts that movement time (MT) is dependent upon the amplitude of the movement and the width of the target. If the perceptual processing influences the pointing task we predict that MT increases when the target is perceived smaller in the size contrast illusion. In addition, we expected that MT increased when the width of the target is physically smaller. Two indices of difficulties (ID) were used to manipulate movement difficulty. The ID was manipulated by different width of the target resulting in ID 3 and ID 5. The task

for the participants (N=10) was to move a pointer dot from a start position into a target circle as fast and accurately as possible. The start and the target were presented in front of the participants. To induce the size contrast illusions the target circles were surrounded by smaller circles (target appears bigger) or larger circles (target appears smaller). Dependent variable was movement time (MT). The results indicated that MT increased with increasing the ID from 3 to 5. However, MT was not affected by the visual illusion effects. This indicated that the size contrast illusion does not lead to inappropriate motor responses in the pointing task, but task difficulty. The results are discussed in terms of different task constraints, and the perception-action coupling.

Effects of head position and trunk loading on unperceived body displacements during stepping on the spot without vision

Paquet, Nicole, Achtereekte, Sarah, Gregory, Anna, Belanger, Amanda, Letourneau, Kylee, University of Ottawa

Stepping on the spot without vision is known to result in unperceived body displacements. Previous studies have shown that the angular displacement (body rotation) was influenced by unilateral neck muscle vibration (Bove et al. 2002), and the linear antero-posterior (A-P) displacement, by ankle loading (Paquet et al. 2014). The aims of this study were to determine the effects of head position in rotation and trunk loading on the angular and linear displacements of the body. Twelve young adults (mean=23 years) were blindfolded and instructed to step on the spot for 100 steps with the arms kept in a forward stretched position (Control condition). Three trials of the following conditions were done in a random order: Head maintained in right rotation (HR) and in left rotation (HL); Backpack weighted with a load corresponding to 15% of the participant's body weight and positioned at the back (WB) and at the front of the trunk (WF). At the end of the 100 steps, the final foot position was marked on the floor. Medio-lateral (M-L) and A-P distances relative to the start line were measured, as well as the angle of rotation. Head rotation position had a significant effect on body rotation and M-L displacement ($p<.01$). Participants moved to the left by a mean of 41 cm and turned counterclockwise by 40° in the HR condition, while they moved to the right by 31 cm and turned clockwise by 46° in the HL condition. Trunk loading had a significant effect on A-P and M-L displacements ($p<.01$). Participants moved anteriorly significantly less in WB (73 cm) than in WF (101 cm) and moved laterally (either direction) significantly less in the weight conditions (WF: 33 cm and WB: 40 cm) than in the Control condition (56 cm). The results suggest that in the absence of vision, the sensory cues and motor actions associated with maintaining the head in rotation and carrying a weight to the trunk influence the control body displacements during stepping on the spot.—*University of Ottawa*

Embeddedness of motor synchrony in circadian rhythm

Park, Chulwook; Kim, Seonjin Kim; Park, Hyeongsaeng; Seoul National University and Carello, Claudia, University of Connecticut

This research explored biological autonomy and control of function in circumstances that assessed a presumed relationship to an environmental cycle. An understanding of this behavior appeals to the organism-environment system rather than simply the organism—we seek to expose the laws that underlie end-directed capabilities by measuring biological characteristics (motor synchrony) in an environmental cycle (circadian temperature). Participants (n = 32) at the University of Connecticut (Storrs, USA) and the Seoul National University (Seoul, Korea) served in the study. The production of in-phase bi-manual coordination was examined at different circadian points (allowing comparison of day-night temperature effects) in two experimental designs; (1) normal temperature embedded in a 24 hour cycle (5:00, 12:00, 17:00, and 24:00), and (2) normal versus abnormal temperature [artificially decreasing or increasing] while embedded at two points (5:00 am, 5:00 pm) during the circadian process. A typical bi-manual stability measure varied significantly as a function of the day-night temperature cycle. While (i) circadian effects under the artificially perturbed temperature manipulation were not straightforward along the day-night temperature cycle, (ii) the circadian effect divided by the ordinary circadian seems to be constant along the day-night temperature cycle. The discovery of direct and robust relation between biological aspects (body temperature and motor synchrony) an environmental process (circadian temperature cycle) may echo adaptation of our biological system to the environment. This relation supports the claim that the organism and the environment should be considered as integrated system in which biological (or physical) dynamics takes place as a mutual factor.—*This research was supported by NSF Grant BCS-1344725 (INSPIRE Track 1), and the Office of International Affairs, Seoul National University.*

Monitoring-pressure enhances the coordination tendencies of bimanual actions

Park, Inchon, Chen, Jing, Buchanan, John J., Wright, David, Mehta, Ranjana, Rhee, Joohyun, Texas AnM; Verwey, Willem B., University of Twente

Previous work has indicated that monitoring-pressure when combined with negative feedback (e.g.,"your performance is poor, you must improve") led to reduced variability in in- phase (IP) and anti-phase (AP) bimanual patterns compared to pressure free performance. The negative feedback statements may be viewed as instruction that resulted in confusion since the statements were vague. Thus, vague instruction and not monitoring pressure may have led to the observed performance enhancement. To investigate this issue three conditions were set-up: 1) no-monitoring; 2) monitoring-pressure no feedback; and 3) monitoring-pressure with negative feedback. The main hypothesis was that monitoring-pressure, whether accompanied by negative feedback or not, would produce an enhancement in performance consistent with previous work. Two control blocks with no pressure were performed prior to block3 when monitoring-pressure was applied. Between subject tests of relative phase and movement frequency from block3 revealed that pressure did not significantly impact performance of the IP pattern. However, there was a trend for performance enhancement when performing IP under pressure compared to no-pressure. For the AP pattern, pressure did significantly impact performance, with participants in the monitoring-pressure and monitoring- pressure with feedback conditions showing less variability of relative phase compared to the no-monitoring participants while moving at faster frequencies. In other words, monitoring- pressure and monitoring-pressure with feedback improved performance. Within subject tests across blocks2 and 3 examining the pressure groups revealed an improvement in performance in block3 compared to block2 based on relative phase variability and movement frequency. These findings show that monitoring pressure and not negative instructions were responsible for the performance change. This finding is not in accordance with explicit monitoring theory that states pressure will prompt individuals to attend closely to implicit skill processes.

Playing games: Deliberate gaming and sport specific knowledge

Parrington, Lucy, Wise, Lisa, MacMahon, Clare, Swinburne University of Technology

In addition to deliberate practice (Ericsson, Krampe, & Tesch-Romer, 1993) and deliberate play (Cote, Baker, & Abernethy, 2007), the development of decision making skill in invasion team sport may be attributed to the accumulation of hours in invasion-type activity (Berry, Abernethy, & Cote, 2008). Sport video game play may be such an activity. Previous work using decision making and general playing ability rankings supports this position (Parrington, MacMahon, & Wise, 2015). In this study, sports participation and video gaming history were collected from 36 inline hockey players at the Australian National Championships. Participants also completed a video-based decision making test. Players were classified as high (>2 years National team), moderate (state level special teams), and low skill (state level non-special teams). Effect sizes (Cohen's d) were used to assess group differences. High skill players outperformed moderate (decision speed d = 0.45, decision accuracy d = 0.65) and low skill (decision speed d = 0.46, decision accuracy d = 0.76) players in the video-based test. Moderate players were more accurate in their decisions than low skill players (d = 0.42). High and moderate skill players had accumulated more hours of sports video gaming than low skill players (d = 0.87, d = 0.595, respectively). High skill players had accumulated less time in structured training than both moderate (d = -0.38) and low skill players (d = -0.376), whilst moderate skill accumulated more than low skill players (d = 0.25). Both high and moderate skill players had participated in more unstructured training than low skill players (d = 0.37, d = 0.24). These results support the notion that sports video games may fall into overall 'invasion-game type activity'. Furthermore, these findings are novel in that they help us define and specify contemporary activities (video game play) that may contribute to perceptual and decision making skill development.

Lower extremity Fitts' task performance by patients with degenerative lumbar spinal stenosis: pre- and post-spinal manipulation

Passmore, Steven R., University of Manitoba; Johnson, Michael G., Uniiversity of Manitoba; Cooper, Stephan, Cleveland Chiropractic College; Aziz, Mina, Aloraini, Saleh, Glazebrook, Cheryl M., University of Manitoba

Fitts' tasks have alterable task difficulty and are resistant to learning making them optimal for performance-based clinical assessment. Degenerative lumbar spinal stenosis (LSS) patients have deficits in lower extremity (LE) Fitts'

aiming movements compared to healthy controls, and post walking those effects are more pronounced (Passmore et al., 2014, 2015). Spinal manipulation (SM) decreases pain in LSS patients (Kirkaldy-Willis & Cassidy, 1985). Our objective was to determine if a single lumbar spinal manipulation session facilitates coordinated LE motor performance in LSS patients. Participants with LSS (N=14) performed baseline testing and underwent a covariate-adaptive randomization to receive SM or no intervention (NI). Participants performed a foot-pointing task to 4 targets with different indexes of difficulty (ID) and completed 10 trials per target, per foot, resulting in 80 total trials both pre- and post- intervention. An Optotrak 3D Investigator (300Hz) recorded movements and dependent variables were calculated including reaction time (RT), movement time (MT), time to peak velocity (ttPV) and peak velocity (PV). Movements were analyzed using 2 Group (SM, NI) by 2 Time (Pre-, Post-) by 4 ID (3, 4a, 4b, 5) mixed ANOVA models with planned comparisons on variables related to Time and Group. Significant main effects for MT, PV, and ttPV were observed across ID as predicted by Fitts' Law. Planned comparisons of the MT main effect revealed significant differences between the two most difficult targets post-SM (ID 4b, M=743ms; and ID5a, M=783ms). For all other comparisons, gross movements required to attain target amplitude superseded any precision movements associated with coordinated movement to targets of different sizes. Participants undergoing SM demonstrated immediate improvement in MT, specifically in their motor performance in the most challenging contexts. Future research on the impact of SM on LSS patients should quantify the impact of a course of care (multiple SM treatments over multiple days), which more closely reflects clinical practice.—*Alexander Gibson Fund*

A comparison of attentional focus effects on golf putt learning in adults and children

Perreault, Melanie E., The College at Brockport, State University of New York; Doan, Robert, Quisenberry, Sean, The University of Southern Mississippi

Evidence strongly supports a learning advantage associated with an external focus of attention in adults (Wulf, 2013); however, the learning effect for children is not as clear. Only a few learning studies have used children and even fewer have directly compared both adults and children learning the same task with similar attentional foci. Thus, the purpose of this study was to compare adults and children learning a golf putt task using attentional focus instructions. It was hypothesized that adults and children using an external focus would outperform those using an internal focus in retention and transfer. In experiment 1, adults (n = 24) aged 19 to 26 years practiced 80 trials of a golf putt task over two days 48 hours apart while receiving either internal or external attentional focus instructions and returned approximately 48 hours later to perform a retention and transfer test. Participants were scored on accuracy and kinematic measures of swing form. The results indicated no differences between groups on accuracy; however, the internal focus group had better swing form during retention ($t(22) = -1.93$, $p = .06$, $d = .79$) and transfer ($t(22) = -2.69$, $p = .014$, $d = 1.09$). In experiment 2, children (n = 26) aged 7 to 10 years practiced 80 trials of a golf putt task over two consecutive days while receiving either internal or external attentional focus instructions and returned approximately six days later to perform a retention and transfer test. Participants were scored on the same measures of accuracy and swing form. The results indicated no differences between groups on accuracy or swing form. Overall, the hypotheses of these two experiments was not supported suggesting that an external attentional focus is not advantageous for adults and children learning a golf putt task. In fact, an internal focus appeared to help adults learn proper swing form more effectively than an external focus. These results will be discussed in relation to the constrained action hypothesis and participants reported thoughts during practice and retention/transfer.

Navigation precision is impaired by a 60-second delay at the beginning of blind navigation

Piekarski, Sarah, Paquet, Nicole, Lajoie, Yves, University of Ottawa

Young adults were found to be accurate in walking without vision towards a previously seen target located up to 10 meters away (Rieser et al., 1990; Paquet et al., 2007). Furthermore, navigation prevision was found to be unaffected by a 30-sec delay period at the beginning of the blind navigation task (Steenhuis and Goodale, 1988). Our research questions are whether navigation precision (1) is modified by a 60-second delay; (2) is decreased if participants are distracted during the delay; (3) varies according to the delay's position into the walking path. This study tested the hypothesis that imposing a 60-second period of delay, with or without a cognitive task, would modify the accuracy of reaching the target located 8 meters away. Thirty young adults (18 to 30 years old) participated. The delay, located at 0, 4, or 7 meters relative to the start line, was either to wait, or to count backwards by steps of seven. Kinematic data were recorded with 8 infrared high-resolution cameras of the Vicon512TM three-dimensional

motion analysis system (Oxford Metrics, Oxford, UK). Measures were taken from participants' final position: total distance travelled, distance to the target, angular deviation, and body rotation. Two-way ANOVA with repeated measures on delay condition (no delay, delay at 0, 4 and 7 meters) and cognitive condition (no cognitive task during the delay, backward counting during the delay) were done. Measures were not significantly different with or without a delay ($p > .05$), and whether or not the delays contained a cognitive task ($p > .05$). However, comparisons among delays revealed a significant effect of delay position with shorter distance travelled ($p < .05$) and larger distance to the target ($p < .01$) occurring at the 0-meter delay, suggesting that a delay at the beginning of the blind navigation task was more disruptive for navigation accuracy than when it occurred closer to the target.—*University of Ottawa*

The effects of visual and proprioceptual sensory conflict on U.S.A. Navy pilots

Porter, Jared M., Southern Illinois Univeristy Carbondale; Geeseman, Joseph W., United States Navy

It is well documented that creating a sensory conflict between the visual and proprioceptual motor systems has a direct effect on motor behavior. The purpose of the present study was to investigate how creating such a conflict impacted the performance of US Navy Unmanned Aerial System (UAS) pilots performing a manual tracking task similar to those required in military operations. Participants were experienced Naval Officers, had passed flight physicals and were qualified to ride in military aircraft. For airborne data collection, participants flew on a United States Navy Lockheed P-3 Orion aircraft. While on the aircraft, participants sat at a table in three different orientations (rear, forward, and side-facing) with a computer monitor in front of them. Using a tethered joystick, participants were instructed to manually track a simulated moving vehicle on the monitor. While participants completed the tracking task, the aircraft followed two unique flight profiles (A and B) in a counterbalanced order. In addition to the airborne trials, participants performed the same tracking task while grounded and seated at a desk. Results showed that grounded trials were more accurate than airborne trials, and tracking performance was more accurate during flight profile A compared to profile B. Results also demonstrated that seat orientation impacted tracking performance. Additionally, the movement of the cursor was more variable for the airborne trails relative to the grounded trials. Interestingly, airborne tracking performance became more accurate through the trials, while grounded tracking performance became worse through the course of the trial. Finally, participants indicated that symptoms of motion sickness were more prevalent during airborne trials than during grounded trials. The results of this study clearly demonstrate that creating a sensory conflict impacted the motor behavior of Navy UAS pilots. Additionally, our findings indicate there are methods that can be taken to reduce the effects of spatial discordance within this population.—*United States Navy*

Analysis of sway characteristics during different attentional focus conditions using sample entropy

Potvin-Desrochers, Alexandra, Polskaia, Nadia, Lajoie, Yves, Ottawa

A study from Polskaia et al. (2015) examined the effects of an internal focus of attention, an external focus of attention and a continuous cognitive task on postural control. The findings suggest that concurrently performing a cognitive task withdraws attention from postural control, enabling a more automatic mode of postural control. Recently, a correlation between center of pressure (COP) regularity and attentional investment was proposed. Roerdink et al. (2006) propose that an increase in COP irregularity reflects a withdrawal of attention from postural control, indicating a more automatic mode of control. The purpose of this study was to perform a supplementary analysis (i.e. sample entropy) on the data from Polskaia et al. (2015) to determine whether a reduction in postural sway during the performance of a concomitant cognitive task could be attributed to an automatic mode of movement control assumption. Ten healthy young adults were asked to stand feet together on a force platform while minimizing movements of the hips (internal focus), minimizing movements of markers placed on the hips (external focus) or silently counting the occurrence of a given digit in a 3- digit auditory sequence (continuous cognitive task). Results revealed no main effect of condition ($p = 0.09$), sway direction ($p = 0.42$) and no significant interaction effect ($p = 0.91$). According to the sample entropy results, it was not possible to detect a switch in attentional behaviour between conditions. However, the results showed a trend toward a slight decrease in the sample entropy, contrary to our hypothesis. We were expecting more irregularity in the COP displacement, which is normally represented by a higher sample entropy. Base on the p value obtained (0.09), it is possible that a significant difference exists between conditions but could not be detected with only ten participants. Further analysis will be needed.

Exploring the pathway between fundamental movement skills and physical activity, and the role of fitness as a mediator.

Powell, Danielle P., Issartel, Johann, Dublin City University; McGrane, Bronagh, Edge Hill University; Barnett, Lisa, Salmon, Jo, Timperio, Anna, Deakin University; Belton, Sarahjane, Dublin City University

Objectives: To explore the hypothesised reciprocal relationship between fundamental movement skill (FMS) ability and physical activity (PA) behavior and investigate the role of fitness as a mediator of this association. Methods: 534 adolescents aged 12.80 years (SD±.45 years) from 20 schools were involved in the study. Using the TGMD-2, the TGMD and the Victorian Skills Manual, 15 FMS were assessed. Actigraph accelerometers were worn for a 9-day period. Evenson et al. (2008) cut points were applied to give average minutes of MVPA per day. Participants completed the 3 minute Queens College step test. A VO2max value was calculated. PROCESS for SPSS, was used to investigate the relationship between PA and FMS and the ability of VO2max to mediate the reciprocal relationship between PA and FMS. Results: A significant positive relationship was found between PA and FMS ($r=0.068$, $p<0.05$). The relationship between FMS and PA, with PA as the outcome was also significant ($r=0.48$, $p<0.05$). A reciprocal relationship was found. The single-mediator model 1, revealed the positive association between PA and FMS was partly mediated by an increase in VO2max. There was a significant indirect effect of PA on FMS through VO2max, ab = .0142, BCa CI [0.00025, 0.0365]. The mediator could account for roughly 17% of the total effect, PM = .1713. The single-mediator model 2 revealed the positive association between FMS and PA was partly mediated by an increase in VO2max. There was a significant indirect effect of FMS on PA through VO2max, ab = .1115, BCa CI [0.0251, 0.2635]. The mediator could account for roughly 19% of the total effect, PM = .1878. Conclusion: A reciprocal relationship exists between PA and FMS, suggesting individuals that participate in PA have greater opportunities to increase their FMS abilities and those with higher skill levels are more likely to participate in PA. Fitness mediated part of this relationship, in both directions. Interventions seeking to see increases in either or both simultaneously, should focus specifically on increasing fitness levels.

The effects of attention-demanding secondary tasks on the immediate and delayed retention and transfer of primary tasks

Raisbeck, Louisa D., Diekfuss, Jed A., Stump, Kiara E., The University of North Carolina at Greensboro

Secondary tasks are used to direct performers' attention towards skill execution (SF) or towards unrelated extraneous information (EX). Beilock and Gray (2012) found that the effects of secondary tasks can spillover to primary task execution after the secondary task is removed. It is unknown if this effect is present during immediate and delayed retention and transfer tests. Participants ($n = 31$) completed a simulated handgun shooting task and were randomly assigned to a control, SF, or EX condition. Shooting performance was measured at baseline, during acquisition, and at two retention times (immediate [10 minutes], delayed [24 hours]) that included transfer tests from a further distance. For the SF, participants were required to report the position of their trigger finger on hearing a randomly-timed audible tone; whereas, participants in the EX were required to identify the frequency of the audible tone. To assess spillover effects, audible tones were only played during acquisition for SF and EX, but were not played for control. Performance results indicated no differences at baseline ($p > .05$), but there was a significant improvement during acquisition from early practice block to late practice ($p = .01$). No differences were observed during the immediate and delayed retention test or during the immediate transfer test ($p > .05$). However, significant differences, were observed during the immediate transfer test ($p = .04$). Post hoc analyses revealed that the EX condition's shooting performance was significantly poorer than the SF and control during the immediate transfer test ($p = .05$, $p = .04$). These results suggest that practicing a motor skill while adhering to an extraneous focus of attention can spillover to transfer tests after a 10 minute rest. These effects, however, dissipated after 24 hours suggesting transfer spillover effects are only evident following a short rest period. We recommend that performers minimize their attention towards extraneous information during practice to improve performance on transferred skills occurring shortly after.

Can a smartphone app be used to objectively measure neuromotor control after a concussion?

Rhea, Christopher K., Kuznetsov, Nikita A., Long, Benjamin, MacPherson, Ryan P., Jakiela, J T., University of North Carolina at Greensboro; Robins, R K., Temple University; Haran, F. Jay, Ross, S E., University of North Carolina at Greensboro; Wright, W. Geoff, Temple University

The development of smartphones over the past decade has allowed researchers to leverage this technology in a variety of ways. One traditional barrier in concussion research was difficulty in objective balance assessment outside the laboratory. While sensitive and specific objective measures have been developed in laboratory environments, field-based and clinical work with patients with a suspected concussion have traditionally relied on subjective balance assessments due to time, financial, and equipment constraints. One potential solution to this barrier is to utilize smartphone technology, which has evolved to include a variety of sensors in an open-access platform in a cost- effective manner. Our research team developed an Android-based smartphone app that collects objective neuromotor data in a dynamic balance test outside the laboratory. Using accelerometer, gyroscope, and magnetometer sensors embedded in an Android-based phone, this presentation will show how neuromotor data can be collected and the potential clinical utility of our smartphone app in concussion research. The Android-based phone sensors were used to detect device orientation from the Motorola X2 (Motorola Mobility, Chicago, IL) and have shown high validity relative to a commercially available inertial measurement unit (XSens, Enschede, Netherlands) and to a motion capture system (Qualisys, Göteborg, Sweden), Pearson's $r > .99$ for both systems. When paired with a stepping-in-place task, our app has also shown adequate between-day reliability and very high within-day reliability (between-day Pearson $r = 0.73$ and within-day $r = 0.93$). The clinical utility of our innovation is the potential ability to measure neuromotor control after a concussion in an objective manner, which can then be compared to normative data embedded within the phone. The final product will be an Android-based smartphone app that will inform the end-user about the dynamic balance ability of their patient relative to a non-concussed population, which could be used within a suite of tests to screen for a concussion.

Improved postural control when performing a cognitive task is not due to stiffening of the ankle joint

Richer, Natalie, Polskaia, Nadia, Lajoie, Yves, University of Ottawa

Recent studies reveal reduced postural sway when using an external rather than an internal focus of attention [1] and further reductions when performing a cognitive task while standing [2]. This could be due to the use of a stiffening strategy (co-contraction of muscles around the ankle joint) [3] or a more automatic postural control [4]. In a recent study from our lab [5] the effect of attentional focus and cognitive tasks on postural control was examined while using electromyography (EMG) to examine muscular activity of the lower leg. Although the external focus and cognitive tasks led to reductions in sway area and variability, no difference was found in muscle activity between conditions. The aim of the present study was to examine co-contraction of the muscles around the ankle as a secondary analysis. The hypothesis was that changes in stability observed in external focus and cognitive task conditions would not be due to co-contraction of lower leg muscles. In the initial project, 13 healthy young adults (age 21.1"3.01) stood with feet together on a force platform while performing 5 conditions in a random order: control standing, internal focus (minimize movement of ankles), external focus (minimize movement of markers extending from ankle joint), and single number (SNS) and double number (DNS) sequences (count and sum the occurrence of 1 or 2 separate digits in a 3-digit number sequence, respectively). Using the EMG data, the time-varying co- contraction index (CCI) was calculated [6]. No difference in CCI was found between conditions. It seems that even though the external focus and cognitive tasks led to a more constrained postural sway, it was not due to the use of a stiffening strategy, suggesting that changes are due to the use of a more automatic postural control. [1]Wulf 2007 Bewegung und Training,1,1-11. [2]Polskaia et al. 2015 Gait Posture,41,454-8. [3]Stins et al. 2011 Hum Movement Sci,30,190-202. [4]Wulf et al. 2001 Q J Exp Psychol A,54,1143-54. [5]Richer et al. 2015 SfN annual meeting,Chicago,IL. [6]Warnica et al. 2014 Gait Posture,39,1115-21

Examining the effects of mixed-models and self-observation on motor skill acquisition within a gymnastics environment

Robertson, Rebecca, University of Ottawa

Throughout a video intervention, models of varying skill level may play different roles in the benefits of observational learning (Buchanan & Dean, 2010); therefore, one can ask whether combining model types could elicit additive benefits. The purpose of this research was to examine this question and we compared the use of self-observation alone to that of self-observation coupled with a skilled model video (i.e. mixed-models) in a gymnastics environment. Twenty-one female gymnasts participated, learning one gymnastics skill with the mixed- models intervention and another with the self-observation intervention. At pre-test, gymnasts observed a skilled model demonstration intermixed with six verbal skill elements that comprised the marking criteria. Next, they executed four physical trials of the skills, and completed an error recall and an error recognition test. These error tests were used to measure possible changes in the cognitive representation of the skills and were analyzed using signal detection. During the next three sessions, athletes first performed a retention test, and then did five blocks of acquisition, consisting of two observation trials and two physical practice trials. At post-test, participants performed a retention test and completed the two error tests again. Physical performance, scored by two evaluators blind to the experimental conditions, revealed a significant condition by session interaction ($F(3,51) = 3.33$, $p = .027$). At session 3 and post-test, scores obtained with mixed-models were significantly higher than those with self-observation. Also, participants had significantly higher response sensitivity scores with mixed-models ($F(1,14) = 10.810$, $p = .005$) compared to self-observation. In conclusion, these results suggest that it is more beneficial to incorporate a mixed-models video (self-observation paired with skilled model) in a gymnastics setting than self-observation alone.—
Ontario Graduate Scholarship

Postural sway during single leg stance depends on stepping direction

Roemer, Karen, Vanderheyden, David, Foch, Eric, Central Washington University

Establishing single leg stance (SLS) requires shifting the center of pressure (COP) onto the supporting leg. After the initial phase (1-3 sec) of SLS, the COP requires postural corrections that will diminish over time in order to maintain SLS (4-10 sec). This study aims to investigate the temporal structure of SLS initiated by a forward step and a sideward step. We hypothesized that initiating SLS via a forward step would increase sway, area, sway velocity, and anteroposterior sway amplitude and reduce mediolateral sway compared to the side step condition. Fifteen subjects (n=15; Age=22.9"2.1 yrs; Mass=73.7"15.7 kg; Ht=174"9 cm) with no previous major lower extremity injury or history of falls performed three 10 second forward and sideward steps to establish SLS. A force plate was used to quantify the sway parameters. Average sway area, sway velocity, and mediolateral and anteroposterior sway amplitude were calculated using principal components. The first nine seconds of SLS (S1’s9) were analyzed with respect to the baseline (S10). A generalized linear mixed model was used for statistical analysis. Sway area was increased during S1 forward compared to sideward ($p<0.01$), sway velocity and medio-lateral sway was increased during S1 and S2 in forward compared to sideward ($p<0.01$), and anterior-posterior sway was increased during S1 and S2 in forward compared to sideward ($p<0.01$) and during S3 in forward compared to sideward ($p<0.05$). The temporal structure of postural sway depends on stepping direction while establishing SLS. In agreement with our hypothesis, during the forward step, SLS sway area and SLS sway velocity were larger compared to the side step. However, mediolateral sway was larger in the forward step compared to the side step. Greater mediolateral sway may be due to significantly larger sway area demonstrated during the forward step compared to the side step. Initiating SLS using a forward step is more demanding than using a sideward step. Collectively, step direction needs to be considered when using SLS to assess postural stability.

Stepping direction alters temporal structure of lower extremity biomechanics in single leg stance

Roemer, Karen,, Vanderheyden, David., Foch, Eric., Central Washington University

Postural control strategies to initiate and maintain single leg stance (SLS) have been identified as ankle, hip, and mixed (ankle + hip) strategies. This study aims to investigate the temporal structure of lower extremity biomechanics during the first ten seconds of SLS for two different stepping directions. We hypothesized that the stepping direction will affect hip and ankle joint kinematics and kinetics during the initial phase of SLS. Fifteen

subjects (n=15; Age=22.9"2.1 yrs; Mass=73.7"15.7 kg; Height = 174"9 cm) with no previous major lower extremity injury or history of falls performed three 10 second forward and sideward steps trials to establish SLS. A six-camera motion capture system synchronized with a force plate collected marker trajectories and ground reaction force data. OpenSim was used to calculate ankle and hip angles, angular velocities, and torques. The first nine seconds (S1's9) of SLS were each analyzed with respect to the baseline (S10). A generalized linear mixed model was used for statistical analysis. Stepping direction affects the temporal structure of ankle and hip joint kinematics and kinetics while establishing SLS. Plantarflexion was increased during S1 in forward compared to sideward ($p<0.05$) Angular velocity was significantly increased in forward compared to sideward for dorsiflexion (S1, S2, S4, $p<0.01$) and hip extension (S1, $p<0.01$). Angular velocity was significantly increased in the ankle (forward, S1 vs. baseline, $p<0.01$) and hip (sideward and forward, S1 and S2 vs. baseline, $p<0.01$). Ankle and hip joint torque were not affected by stepping direction. Joint torque was significantly reduced in the ankle (sideward and forward, S2 vs. baseline, $p<0.05$) and increased in the hip (sideward, S1 vs. baseline, $p<0.01$, and forward, S1, S2 and S3 vs. baseline, $p<0.05$). Both stepping directions caused subjects to adopt a mixed balance strategy during the early phase of SLS. Initiating SLS after a forward step is more demanding than using a sideward step.

The effect of focus of attention on learning to kick in novice taekwondo athletes

Roseman, Alyssa, Sherwood, David E., University of Colorado, Boulder

Previous research has shown that focusing externally (outside the body) leads to better motor performance than focusing internally (within the body), yet many coaches and other instructors continue to use internal cues to teach. This is the first study to use electromyography (EMG) to assess the distance effect, to examine the benefit of a distal external focus of attention beyond a target, and to test the constrained action hypothesis in a stationary, dynamic task. People who did not have much experience in martial arts (n = 20) kicked a force bag while EMG was recorded using different verbally cued foci of attention. Each participant focused on the muscles of his or her upper leg (internal focus condition), the circle on the bag (proximal external focus condition), and the researcher holding the bag (distal external focus condition). The mean force-accuracy (F-A) in the internal, proximal external, and distal external conditions were 38.699, 38.716, and 43.482, respectively. The differences in F-A and cocontraction between conditions were significant. Cocontraction and F-A were negatively correlated in the distal external focus condition, but positively correlated in the internal focus condition. These findings suggest that cocontraction may be beneficial in certain circumstances, but not in others. In a follow-up to this study, an ongoing experiment uses an accelerometer to record the acceleration of the leg while kicking. The acceleration will be correlated to force and thus differentiate between the force component of the force bag measurement and the accuracy component.

The effects of anxiety and situation-specific context on perceptual-motor skill: A multi-level investigation

Runswick, Oliver R., Roca, Andre, St Mary's University, Twickenham, London; Williams, Mark, Brunel University, London; North, Jamie S., St Mary's University, Twickenham, London

When performing under anxiety, a decrement in performance is often observed. Nieuwenhuys and Oudejans (2012) reported three operational levels at which anxiety can influence goal-direction actions, namely, attentional, interpretational, and behavioral. In this model, which is grounded in Attentional Control Theory (ACT; Eysenck, Derakshan, Santos, & Calvo, 2007), they suggest that performance under anxiety is affected by the limited capacity of the working memory. However, most researchers that have tested ACT have employed protocols or secondary tasks that are not representative of performance environments and limited attention has been paid to how situation-specific context affects cognitive load and perceptual-motor performance. We examined how anxiety and situation-specific contextual information affected the processes underpinning perceptual-motor performance at three different levels (attentional, interpretational, and behavioural) in an in-situ setting. Twelve skilled cricket batsmen played against a skilled spin bowler under four different conditions, manipulated to induce low- and high-levels of anxiety and low- and high-levels of situation-specific context. Performance was judged on the quality of bat-ball contact (Muller & Abernethy, 2008). Eye-movements, verbal reports, and kinematic data were recorded as process measures. High anxiety decreased the number of good bat-ball contacts, while high context increased the number of times no contact was made with the ball (all p's<0.05). There were changes in visual search behaviors under high anxiety conditions, with significantly more fixations of shorter duration to more locations (all p's<0.05). The effects of anxiety appear to be isolated at the perceptual level with cognitive and behavioural measures unaffected. Findings

provide support for ACT by showing a decrease in the efficiency of perceptual mechanisms, suggesting that increasing load on the working memory using situation 'specific context may affect performance in a different way to artificial and non-representative secondary tasks.

The effect of walking speed on local dynamic stability depends on the body part measured

Russell, Daniel M., Old Dominion University; Haworth, Joshua L., Johns Hopkins University; Morrison, Steven, Old Dominion University

While movement trajectories of body parts during gait are relatively consistent, they are also inherently variable. The resistance of these trajectories to small, natural, intrinsic perturbations can be computed as the maximum Lyapunov exponent, which provides a measure of local dynamic stability. Previous research has provided evidence of two different relationships between walking speed and local dynamic stability. According to the resonance hypothesis, local dynamic stability is maximal at the preferred speed of walking and decreases for slower or faster speeds (Russell & Haworth, 2014). In contrast, the slow speed hypothesis proposes that local dynamic stability increases as walking speed slows (Dingwell & Marin, 2006). Evidence for these hypotheses is based on findings for different parts of the body, and so far head stability has not been quantified, which could be critical to performance of walking. Twelve young, healthy participants walked overground along a 65 m walkway at five speeds relative to their individual preferred speed: 50, 75, 100, 125, and 150%. Electrogoniometers measured sagittal plane knee motion and two tri-axial accelerometers measured acceleration of the trunk and head in antero-posterior (AP), medio-lateral (ML) and vertical (VT) axes. Local dynamic stability was computed for each axis of each sensor. Local dynamic stability of both knees was maximal at the preferred speed and decreased with slower or faster speeds. For the trunk, local dynamic stability was maximal at 75% of the preferred speed in the ML axis and increased with decreasing speed in the VT axis. For the head, faster speeds led to maximal local dynamic stability in the AP and ML axes. The AP axis of the trunk and VT axis of the head were not significantly influenced by speed. Clearly, the effect of speed on local dynamic stability varies depending on the particular body part being measured. Knee motion supports the resonance hypothesis, while VT trunk accelerations support the slow speed hypothesis. Local dynamic stability of the head did not support either hypothesis.

Effect of standing on Jebsen Taylor Hand Test performance

Saba, Ashley, Baer, Jessica, Kolar, Melissa, O'Donnell, Michael, University of South Carolina; Schaefer, Sydney Y., Utah State University; Stewart, Jill C., University of South Carolina

Upper extremity impairment is common in individuals with neurologic diagnoses, and arm function is often assessed with standardized outcome measures such as the Jebsen Taylor Hand Function Test (JTHFT). However, standardized measures of arm function, including the JTHFT, have only been validated in sitting, even though many daily functional tasks are performed in standing. Valid and reliable tests of arm function in standing are needed. As a first step, the purpose of this study was to examine the effect of standing on JTHFT performance. Twelve right-hand dominant, nondisabled adults (age 26.3"3.1) performed seven items of the JTHFT in sitting and standing with both the right and left hand (arms tested one week apart). Six practice trials were completed in sitting before testing, and the order of test position and hand were counterbalanced across participants. Total time and time to compete each subtest were used in analyses. Center of pressure measurements were taken during all standing trials to quantify postural sway. Total time to complete the JTHFT was similar between the right hand (mean seconds " standard deviation: sitting: 26.3"2.3; standing: 27.5"2.9) and left hand (sitting: 26.2"1.8; standing: 27.7"2.9). Overall, total JTHFT time significantly increased from sitting to standing (F=11.97, p=0.005 for main effect of position). Subtests involving object manipulation (e.g. feeding, checker stacking) tended to show the greatest effect of standing. Overall, postural sway (path length, velocity, path area) increased during JTHFT performance compared to static stance in a similar manner with both the right and left arms. Even in this group of young adults, standing led to increased time to complete the JTHFT. These results may have implications for older adults and individuals with neurologic diagnoses in whom deficits in both upper extremity function and postural control may be present. The capacity to perform arm tasks in sitting may not fully indicate the ability to perform functional tasks in a real-world environment that includes standing.

The effect of knowledge of results through visual feedback on the precision of navigation without vision
Sarjeant, Jenna, Grostern, Jessica, Paquet, Nicole, Lajoie, Yves, University of Ottawa

Walking without vision to reach a previously seen target involves the integration of sensory inputs, motor actions and cognitive functions (Wolbers and Hegarty, 2010). It is not clear whether the distance and direction errors associated with this complex task (Elliott 1987, Paquet et al., 2007) could be reduced if knowledge of results is given. The aims of this study were to determine whether navigation precision would improve immediately after 10 learning trials in which visual feedback was provided and whether such improvement would be carried over to the next day. Twenty-one young adults (mean of 21 years old) were instructed to look at a target on the floor at a distance of 8 meters away and then to walk blindfolded until they believed they had reached the target. In the 10 consecutive learning trials, participants were allowed to look at their final position relative to the target. Five trials of each testing condition were done: Pre-learning, Post-learning (immediately after the learning trials) and Retention (the next day). The final foot position was marked on the floor and the lateral (X) and longitudinal (Y) distances relative to the target were measured. The square root of X2+Y2 was calculated to obtain the distance to the target (DT) regardless of direction. Variable errors were calculated as the standard deviation (SD) of the five trials for each condition. The results showed that DT was significantly smaller in Post-learning (mean of 49 cm, $p < .01$) and in Retention (63 cm, $p < .01$) than in Pre-Learning (94 cm), but DT was not different between Post-learning and Retention ($p > .05$). The variable error of DT was significantly smaller in Post-learning (mean of 25 cm, $p < .05$) and in Retention (28 cm, $p < .01$) than in Pre-Learning (46 cm), but it was not different between Post-learning and Retention ($p > .05$). The results indicate that knowledge of results through visual feedback improved navigation precision as well as trial-to-trial consistency. It suggests that visual feedback can influence the perception of self-motion and/or the memory of target.—*University of Ottawa*

Postural sway and ankle stiffness during continuous cognitive tasks and internal and external focus of attention
Saunders, Deanna, Richer, Natalie, Phillion, Annabelle, Lajoie, Yves, University of Ottawa

The characteristics of an ankle strategy as proposed by Winter (1995) consist of a decreased sway amplitude and an increased mean power frequency. Various studies have outlined ways in which an ankle strategy is conceived, though there is no general consensus on this. The objective of this study was to examine postural control while performing two separate continuous cognitive tasks (single number sequence and double number sequence), internal and external focus of attention, and active ankle stiffening. More specifically this study set out to determine if the use of a continuous cognitive task promotes a more automatic control of posture compared to the other conditions. Also to examine which condition if any, exhibits the characteristics of an ankle stiffening strategy. 11 young adults (20 years) performed a quiet standing task consisting of 6 conditions: baseline, internal focus (IF), external focus (EF), single number sequence (SNS), double number sequence (DNS) and active ankle stiffening. There were 36 trials, 6 per condition. Results displayed no significant difference across the conditions for mean velocity in the anterior/posterior (AP) and medial/lateral (ML) directions. There was also no significance for mean power frequency in both the AP and ML directions across the conditions. There was however a significant difference for sway area ($p < .001$). With the smallest areas coming from EF, SNS and DNS compared to baseline. There was also a significant difference for standard deviation (SD) of centre of pressure (COP) in both the AP and ML directions ($P < .001$). The DNS condition demonstrated smaller SD of COP in both the AP and ML directions compared to baseline, active stiffening and IF. These results suggest an enhanced postural stability when performing a continuous cognitive task as viewed in the decreased sway variability in both directions and also smaller sway area. There was no difference in MPF across the conditions leading to believe that participants were not using a stiffening strategy to regulate postural stability.

Language and motor control - Early neurophysiological interaction of conceptual and motor representations
Schack, Thomas, Vogel, Ludwig, Koester, Dirk, Bielefeld University

Handling our everyday life, we often react manually to verbal requests or instruction, but the functional interrelations of motor control and language are not fully understood yet, especially their neurophysiological basis. Here, we investigated whether specific motor representations for grip types interact neurophysiologically with

conceptual information, i.e., when reading nouns. Participants were asked to make lexical decisions on letter strings and, for words, to perform a grasp-and-lift task on objects of different sizes involving precision or power grips while the electroencephalogram was recorded. Nouns could denote objects that require either a precision or a power grip. In a control block, participants pointed at the objects instead of grasping them. Eventrelated potentials (ERPs) showed an early interaction of grip type and conceptual information (100-200 ms after noun onset) which was not present for pointing. Later, conceptual information elicited an N400 effect (500-650 ms; in grasping). These findings attest that grip type and conceptual information are functionally related and that their interaction is specific for grasping. Generally, the results support the suggestion that control of behaviour is modulated by task demands; conceptual noun information may gain priority if the task requires a complex motor response.—*This research/work was supported by the Cluster of Excellence Cognitive Interaction Technology 'CITEC' (EXC 277) at Bielefeld University, which is funded by the German Research Foundation (DFG)*

Scaffolding in motor learning - The impact of practice on action representation, gaze behavior and performance

Schack, Thomas, Bielefeld University; Land, William, University of Texas-San Antonio; Frank, Cornelia, Bielefeld University

Despite the wealth of research on the learning of a motor action, little is known about the perceptual-cognitive changes that occur over the course of learning. In a recent study, we examined changes in one's mental representation, quiet eye behavior, and outcome performance over the course of skill acquisition. Novices (N = 45) were assigned to one of three conditions: physical practice, physical practice plus mental practice and no practice. Participants in the practice groups trained on a golf putting task over the course of three days, either by repeatedly executing the putt, or by both executing and imaging the putt. Findings revealed improvements in putting performance independent of practice condition. Regarding the perceptual-cognitive background of performance changes, participants practicing mentally in addition to physical practice revealed more elaborate representation structures and longer quiet eye durations in comparison to the control group, while this was not the case for participants who underwent physical practice only. Thus combined mental and physical practice led to advanced action representation in memory and improved attentional focus prior to movement onset. The results suggest that perceptual and cognitive adaptations co-occur over the course of motor learning, especially in the combination of physical and mental practice. Consequences for the understanding of cognitive-perceptual components in motor control and for a new kind of mental training are discussed.—*This research/work was supported by the Cluster of Excellence Cognitive Interaction Technology 'CITEC' (EXC 277) at Bielefeld University, which is funded by the German Research Foundation (DFG)*

Influence of concussion history on pre-season neuromotor and neurocognitive performance in female American football players

Schleich, Kristen N., Washington, Leah, Glass, Steven M., Ross, Scott E., Etnier, Jennifer L., Duffy, Donna M., Rhea, Chris K., University of North Carolina at Greensboro

There has been a rise in female athlete participation in American football, which is defined as a collision sport where athletes intentionally collide into each other. Collision sports are associated with a relatively high rate of concussion incidence and with short- and long-term negative consequences. Neuromotor and neurocognitive assessments are commonly used to evaluate sequelae in athletes who have a suspected concussion, but it is unclear how previous concussions may influence preseason baseline testing. This pilot project examined the association between concussion history, and neuromotor and neurocognitive performance. The number of previous concussions was self-reported in the preseason by female athletes (N=31 age=29.0"7.0 yrs, tackle football experience=2.7"1.7 yrs) from two Independent Women's Football League teams, who were also assessed with a neuromotor test [Modified Balance Error Scoring System (mBESS)] and a neurocognitive test [(Trail Making Test A and B (TMT_A and TMT_B)]. Pearson correlations (r) were used to examine associations between concussion history, and neuromotor and neurocognitive performance. The average number of previous self-reported concussions, number of days since the most recent concussion, and the duration of recovery was self-reported as 0.9"1.6 concussions, 556.3"925.3 days, and 38.3"196.2 days, respectively. Results showed a near positive correlation between concussion history and TMT_A, r (29)=.347, p=.056. All other correlations were not significant (p>.05), potentially due to the relatively

high variation in our small sample (coefficient of variation >20% for all variables). A higher score on the TMT_A indicates worse neurocognitive performance, so the positive correlation indicates that a higher number of previous concussions is associated with worse performance on a measure of information processing. Thus, in addition to examining the acute effect of a concussion on neurocognitive and neuromotor performance, the chronic effect on performance due to previous concussion history should be further examined.

Attentional focused feedback and underhand tossing in a first grade physical education setting

Seneri, Amanda B., University of the Incarnate Word; Petranek, Laura J., Boise State University; Bolter, Nicole D., San Francisco State University

Research has shown that externally focused instruction and feedback has positive effects on motor skill acquisition among adults (Wulf, 2013). However, the inclusion of children in the attentional focus literature is needed, especially those under the age of eight, whose cognitive development is less mature than older children or adults (Thomas, 1980). Therefore, our purpose was to examine the effects of attentional focused instruction and feedback on the accuracy and movement form of an underhand tossing task among first graders. It was hypothesized the external group would perform with greater accuracy and better movement form compared to the internal group. Three intact classes of first graders (mean age = 6.81 yrs) over four days completed a pretest (10 trials), acquisition period (5 blocks of 10 trials), retention test (10 trials), and transfer test (10 trials). Within each class, participants were randomly divided into an external (n = 14) or internal (n = 12) attentional focused group. Feedback provided was congruent with the external or internal attentional focused instruction received (e.g., "Place your opposite shoe/foot forward when you begin your toss"). Movement form was assessed on a 4-pt scale and accuracy was assessed on a 10-pt scale using a circular target. At the end of each day, participants were asked how often they focused on the cues provided. Repeated measures ANOVAs were conducted on the acquisition (2 X 5) and retention (2 X 2) periods, while t-tests were run to assess group differences on the transfer test. No significant main effects or interactions emerged between groups or over time and thus the hypothesis was not supported. Both groups had similar mean scores during acquisition, retention, and transfer trial blocks for movement form and accuracy. A majority of participants in both groups across all four days reported focusing on the attentional cues “sometimes" or "always". These findings highlight the need to adopt a developmental perspective when studying attentional focused feedback and instruction among young children.

Direction and relevance of the focus of attention in dart-throwing with and without concurrent visual feedback

Sherwood, David E., University of Colorado; Lohse, Keith, Auburn University; Healy, Alice F., University of Colorado, Boulder

Many research studies have shown the advantage of directing the focus of attention (FOA) externally relative to internally. However, it is not clear how vision might impact attentional processes as the FOA is shifted between internal, external, relevant, and irrelevant sources of attention. The current experiments varied the FOA by asking the participants to judge joint angles (internal-relevant), body sway or respiration (both internal-irrelevant), dart trajectory or dart release (both external-relevant), and tone loudness (external-irrelevant) at dart release in which task-intrinsic concurrent visual feedback was available or not. Thirty throws were made in each condition with the order of conditions determined by a 4 x 4 Latin Square. In Experiment 1 (N = 48), participants threw darts with vision available, in Experiment 2 (N = 72) participants were randomly assigned to either a vision or no vision group. Mean radial error was the main measure of spatial accuracy and movement precision was measured with bivariate variable error. Spatial errors and trial- to-trial variability in the outcome were reduced when vision was available. Spatial errors were greater during internal judgments compared with external judgments particularly when vision was not available when making judgments about task-relevant factors. Whether a focus on irrelevant factors affected spatial error compared with relevant factors, depended on the specific irrelevant task used. A focus on body sway or tone loudness did not disrupt performance when vision was available, but a focus on the breath cycle did disrupt performance in both visual conditions in Experiment 2. These findings suggested that vision modulates focus of attention effects in motor control.

Human motor behavior: From neuroimaging to human-robot dynamics--Functional near infrared spectroscopy (fNIR): Issues and considerations for application to human performance and human-robot interactions

Shewokis, Patricia A., Shariff, Faiz U., Drexel University; Gentili, Rodolphe J., University of Maryland-College Park; Izzetoglu, Meltem, Drexel University

Functional near infrared spectroscopy (fNIR) is a noninvasive, nascent optical imaging tool to monitor changes in hemodynamic responses within the cortex in response to sensory, motor or cognitive activation. FNIR technologies allows for the design of portable, safe, accessible and affordable brain activity monitoring systems that can be used in both laboratory and ecologically-valid real-world settings (e.g., sporting fields, gyms, walkways, operating rooms, intensive care units, emergency rooms, offices, and so forth). Our focus will be the use of an fNIR sensor that monitors prefrontal cortex (PFC) activation during the performance of various cognitive-motor tasks by humans and human-robot interactions in a number of settings. The PFC is the highest cortical area responsible for motor planning, organization and regulation; it integrates sensory and mnemonic information, it regulates cognitive function and action, and works with other cortical circuits with executive functions. Advantages of using fNIR systems include robustness to movement artifacts along with task flexibility which allow for the capture of valuable information during neuroimaging and behavioral research. Use of any neuroimaging system involves consideration of methodological, data acquisition, signal processing, statistical analysis and data interpretation processes. In this symposium, issues and considerations regarding the use of fNIR will be discussed from four perspectives: 1) movement scientist and statistician; 2) clinician/surgeon; 3) kinesiologist/roboticist; and 4) biomedical and electrical engineer. Discussion will conclude with recommendations for best practices when using fNIR in human and human-robot research.

Effect of stepping rate and resistance on lower extremity electromyography in recumbent stepping

Siekirk, Nicholas J., Pardo, Victoria, Lai, Qin, Galen, Sujay, Wayne State University

Muscles of the lower extremity are recruited in a reciprocal pattern while performing recumbent stepping. However, the effects of different stepping rates or increased resistance on muscle activity have not been investigated in a recumbent stepper. The purpose of this investigation was to study the electromyographic (EMG) activity of 12 lower extremity muscles during five different stepping protocols (self-selected level 1 [SSL1], self-selected level 8 [SSL8], +20% self-selected [SS+20], -20% self-selected [SS-20], and 80 steps per minute at resistance level 1 [80SL1]). 22 healthy male and female adults (aged 18-45) voluntarily participated in the study. Self-selected cadence was established during 10 minutes of stepping with a rate of perceived exertion of 12-16. Subject's self-selected (SS) cadence was 126.80 " 17.87 steps/minute (spm). Participants performed all five protocols in randomized order with 5 minutes of rest between each protocol. Both mean (mEMG) and peak (pEMG) normalized amplitudes were recorded from the rectus femoris (RF), vastus medialis oblique (VMO), semitendinosus (ST), tibialis anterior (TA), medial gastrocnemius (MG) and soleus (SOL) bilaterally. One-way ANOVA with repeated measure on protocols revealed main effects of protocol for all the recorded muscles ($p<.05$). Further, Duncan's NMRT indicated that that SSL8 produced the highest mEMG and pEMG in all muscle groups ($p<.05$). SS+20 (150.80 " 20.91 spm) resulted in the second highest mEMG in RF, MG and VMO and second highest pEMG in RF and VMO. Generally, SSL1, SS-20 and 80SL1 did not differ in most measurements of mEMG and pEMG ($p>.05$). The present findings indicated that increased resistance (SSL8) resulted in largest mEMG and pEMG outputs. Increased step rate also led to enhanced neuromuscular recruitment of lower extremity musculature.

Frontal vs. posterior cognitive dysfunction: Does greater risk of dementia lead to a differential gait in Parkinson's disease?

Silveira, Carolina R. A., Movement Disorders Research and Rehabilitation Centre at Wilfrid Laurier University and University of Waterloo; Roy, Eric A., University of Waterloo; Almeida, Quincy J., Movement Disorders Research and Rehabilitation Centre at Wilfrid Laurier University

Gait impairment is common in Parkinson's disease (PD), and it has been suggested to precede the onset of dementia. In PD, gait impairment has been associated with deficits in cognitive domains relying on frontal lobe functioning, such as executive functions. In contrast, gait deficits have not been linked to cognitive domains mediated by

posterior brain areas responsible for memory, language, and visuospatial functions that are argued to be strong predictors of PD dementia. Yet, it remains unknown whether non-demented PD patients that have a greater risk of developing dementia (posterior deficits) show differences in gait when compared to those with executive functioning deficits (frontal deficits) or those with normal cognition. Thus, this study aimed to compare gait of individuals with PD showing "posterior", "frontal", or no cognitive impairment (NCI). Based on a sample of sixty-four individuals with PD, median scores were calculated for three "frontal" (Stroop, Trail Making Test, Digit Span) and three "posterior" (Pentagons, Semantic Fluency, California Verbal Learning Test) neuropsychological tests. Participants were allocated into the Frontal (n=14) or Posterior (n=12) groups if they showed at least 2 out of 3 scores lower than the median in frontal or posterior tests, respectively. Participants with 0 or 1 score lower than the median were classified as NCI (n=22), and those with lower scores in both frontal and posterior tests were excluded (n=16). Participants walked under single and dual task (digit monitoring) conditions. Main effects of Task showed that all groups walked slower in the dual task condition, with greater step-to-step variability, wider base of support, and longer double support phase ($p<0.05$), but no differences between groups were identified during single or dual-task walking. Thus, this study suggests that PD patients at greater risk of dementia walk similarly to those with frontal deficits and those with normal cognition.

The effects of spacing practice and practice schedule on motor memory consolidation during the acquisition of a bimanual coordination movement pattern

Song, Yonggwan, Korea Univ.; Cheon, Sung Hyeon, Kangwon National University; Park, JinHoon, Reeve, Johnmarshall, Korea University

The processing of a motor memory continues long after the completion of a practice repetition, a phenomenon known as memory consolidation. The present study was designed to identify the factors that influence the effectiveness of this consolidation processes, leading to a relatively stable and long-term motor learning in the production of a bimanual coordination movement that required 90-deg phase offset. In Experiment 1, three groups of participants (n=24) practiced the task either 3, 4, or 5 blocks of 9 trials in each block, respectively, for 4 days. A retention test was administered 24 hours (on day 5) after the practice session. No significant differences emerged among the groups on the accuracy and stability of their bimanual coordination patterns, suggesting that the amount of practice did not influence the consolidation processes. In Experiment 2, the same task was practiced in 4 sessions of 4 blocks each, and the practice sessions were separated by either 5 minutes, 1 hour, 4 hours, or 24 hours (1 day). The 24-hour group showed more accurate and more stable performance during the retention test than did the remaining 3 groups (which did not different significantly from one another), suggesting that distribution of practice over a relatively long period of time (day), rather than amount of practice per se, is a more important factor for the enhancement of learning in the production of a complex bimanual coordination task.

Gait dynamics in a rhythmic auditory stimulation task that induces symmetrical or asymmetrical walking

Stout, Ruth D., UNC-Greensboro; Cessford, Kimberley C., Burridge, Jane H., University of Southampton; Whitall, Jill H., University of Maryland; Rhea, Christopher K., University of North Carolina in Greensboro

Rhythmic auditory stimulation (RAS) is commonly used to provide a signal to which a participant can synchronize, with the intention of creating more symmetrical or asymmetrical movement, depending on the pre-existing condition. However, it is unknown how small variations between gait cycles (termed gait dynamics) are altered when RAS is employed in various forms. Young healthy women (N=11, 20.4 "1.9 yrs) with no visual or hearing losses were fitted with Gait Up Physiolog sensors and walked at a self-selected speed on a figure-eight path with 15"x3" ovals in seven conditions: (1) baseline (BL; no RAS for 10 min), (2) symmetrical RAS (S; 50:50 ratio between limbs for 10 min), (3) retention (RET; no RAS for 5 mins) (4) abrupt asymmetrical RAS (AA; 66:34 ratio between limbs for 10 min), (5) RET, (6) progressive asymmetrical RAS (PA; 50:50 ratio between limb progressing 2% per min to a 66:34 ratio at the 8 min mark, then 66:34 ratio maintained for 2 min), and (7) RET. Gait dynamics were calculated by submitting the step time and step length time series to detrended fluctuation analysis (DFA), which provides an alpha (α) metric that indicates whether the time series is trending toward random (DFA $\alpha = 0.5$) or persistent (DFA $\alpha = 1.0$) behavior. A condition effect was observed for step time, $F(6,60) = 2.33$, $p = .04$. Relative to the BL condition (M=0.58, SD=0.07), only the S condition (M=0.51, SD=0.06) significantly altered DFA α. A condition effect was also observed for step length, $F(6,60) = 7.17$, $p < .001$. Relative to the BL condition

(M=0.56, SD=0.10), the AA (M=0.68, SD=0.12) and PA (M=0.76, SD=0.17) conditions significantly altered DFA α. of the significant changes were retained after RAS was turned off. The low DFA α values relative to previous studies suggests that the constraint of walking in a figure-eight path changes gait dynamics, regardless of whether RAS was used or not. Further, the increase in DFA α in various RAS condition suggests that participants adopted a more persistent (i.e., less random) pattern in their gait to comply with the RAS constraint.

Motor and verbal perspective taking in children with Autism Spectrum Disorder

Studenka, Breanna E., Cummins, Daisha L., Gillam, Sandra, Gillam, Ron, Utah State University; Hartzheim, Daphne, Louisiana State University; Myers, Kodey, Utah State University

Children with Autism Spectrum Disorder (ASD) have difficulty developing language skills and communicating with others via non- verbal mechanisms such as hand gestures, eye contact and facial expression. Individuals with ASD may also have marked deficits in planning for future actions (Glazebrook et al., 2009; Hughes, 1996), which might lead to impairments in non-verbal communication. The ability to understand the perspective of another is typically assessed using scenarios whereby the participant imagines how an actor would interact in a social situation (e.g., Sally Anne task; Baron- Cohen, 1985). This paradigm allows little dissociation between the verbal comprehension of the paradigm and the associated response. Recently (Gonzalez et al., 2011; 2013) a new task placed emphasis on understanding intentions portrayed by motor actions. The aim of the current study was to evaluate the motor planning capabilities of five children with ASD (7-9 years old) as they underwent a narrative intervention over the course of about 16 weeks. Once a week, the participant sat across from a researcher. Either a stick or a hammer was placed in front of the participant. The participant was instructed to help the researcher use the tool or put it away. Four out of five participants learned, over time (~ 7 sessions), to hand the objects in a manner that facilitated the experimenter's action. Furthermore, the increase in helping behavior paralleled an increase in use of mental state and causal language indicating a link between verbal and motor perspective taking. An additional task verified that children with ASD based their actions more on maintaining the previous grasp than on comfort suggesting that children with ASD have a difficult time changing motor plans. Children with ASD also took longer than control children to plan actions. Because motoric understanding and planning may preclude verbal understanding and communication, interpersonal joint-action tasks, such as the one described above, could become a valuable tool for early assessment and intervention.

A performance evaluation of ball-bouncing movements of children at an elementary school

Sugao, Hisayo, Hiroshima Shudo University

Taking the teacher's evaluation points into the student's learning points is a task of education designers. Therefore, the purpose of this study was to clarify and systematize viewpoints of observation for evaluating ball bouncing movements (BBMs) of elementary school children. From 1st grade to 6th grade of elementary school children participated in this study. They were instructed to keep bouncing a ball with the dominant hand for 20 sec. The number of consecutive and the duration time on BBMs and quality of movement were analyzed by the author. The viewpoints of quality of BBMs were height of bounce, ball location at bounce and tempo of bounce. Each grade children were differentiated upper-ranked group and lower- ranked group from the time of keeping bouncing a ball for 20sec and the data were statistically processing. Results showed that lower-ranked group did not have the skill of BBMs more than upper-ranked group was reflected by the viewpoints. And a variety of movement patterns led to the same number of successive bounce, suggesting that not only the outcome but also the quality need to be evaluated. For the result of this study, it has been possible for BBMs to identify distinguishing features across all grades of elementary school students and for each grade.

Movement planning and postural adjustment in single and multiple step initiation

Sun, Ruopeng, Indiana University Bloomington; Zhao, Tianyu, Indiana University; Shea, John B., Indiana University Bloomington

In step and gait initiation task, the anticipatory postural adjustment (APA) patterns and duration offers a unique window to probe the cognitive motor planning process for step execution and locomotion control. In this study, we investigated the difference between single step and multiple step initiation tasks to better understand the mental

chronometry for locomotion planning. Eight young healthy adults participated in this study. Subjects were asked to stand upright on a force platform and to initiate forward stepping as quickly and accurately as possible in response to a visual cue displayed on a TV screen placed at 4 m ahead of them. The visual cue consists of six squares placed equally distanced at the center of the screen in a three row by two column manner. The three rows indicated that there were 1-3 possible forward steps, and the two columns on either side of the screen indicated the side of the landing foot. During the task, only one of the six squares was displayed in color, which required subjects to plan their steps corresponding to the location of the cue. After the swing foot corresponding to the visual cue landed, the subject brought the stance foot next to the swing foot and stood upright. Each subject performed 60 trials in a simple reaction task (SRT) condition and 60 trials in a choice reaction task (CRT) condition. The CRT induced significant longer reaction time and APA duration than the SRT for step preparation. The multiple step initiation task induced a longer APA duration than the single step initiation task, but did not alter the reaction time for movement onset. This indicates that the motor planning for single and multiple steps differs only during the postural adjustment period. Interestingly, the single step initiation task induced a longer double support phase (DSP) duration, reduced propulsion force, and increased brake impulsion compared to the multiple step initiation task. This indicates the motor planning for step termination was programmed and executed in the double support phase, and not during the APA period.

Effect of aging on step adjustments to perturbations in visually cued gait initiation

Sun, Ruopeng, Cui, Chuyi, Shea, John B., Indiana University Bloomington

The ability to make step adjustments in response to sudden perturbation is essential for fall avoidance. The incorrect strategy in body weight shift during step adjustments could lead to loss of balance and serious injury among the elderly. Therefore, the cognitive processing to inhibit original motor planning, and select and execute alternative motor commands in a timely manner is critical in locomotion control. The present study investigated the aging effect on step adjustments in response to a stepping-target perturbation during visually cued gait initiation. Ten healthy elderly adults and ten healthy young adults were recruited to participate in this study. Subjects were asked to stand upright on a force platform, initiate forward walking with their right foot, step on to a projected foot sized visual cue located at a step length ahead of them, and continue walking on the 5 m walkway. After the initial stimulus to trigger subjects' motor planning for gait initiation, the location of the visual target was either unchanged, or randomly relocated laterally or medially by 10 cm. The relocation of the visual target disrupted the preplanned step and triggered the online postural adjustments to select an alternative foot landing position. Three trigger timing conditions (Early, Intermediate, Late) for target relocation were performed based on real time force analysis of subjects' weight distribution during the gait initiation cycle. Elderly subjects showed delayed reaction time, extended double support duration for the initial step across all test conditions. Elderly subjects also exhibited more undershoot in foot placement during the intermediate and late target shift conditions. Furthermore, in the late target shift condition, elderly subjects rotated their foot more prior to landing in order to step on the target, resulting in more difficulty in maintaining postural stability, and increasing variability in subsequent step performance. These findings suggest that older adults have decreased ability to select and execute alternative steps under time pressure.

Can flexibility be increased in point-to-point movements?

Tuitert, Inge, Aix-Marseille University and University of Groningen; Mouton, Leonora J., University of Groningen; Boostma, Reinoud J., Aix-Marseille University; Otten, Egbert, Schoemaker, Marina M., Bongers, Raoul M., University of Groningen

Flexibility is the variability in joint angle configurations while stabilizing the fingertip position. A high flexibility allows to perform stable behavior under perturbations and to handle a secondary task. We aim to increase flexibility in pointing movements after practice through enlarging the range of joint angle trajectories used. We expect that the newly explored joint configuration patterns in the manipulation will result in more joint angle variability and that this will result in more flexibility after practice. With the UCM method we partitioned variability in joint angles over repetitions in two types of variability: a) goal equivalent variability (GEV): variability that does not affect the fingertip position, and b) non-goal equivalent variability (NGEV): that does affect the fingertip position. The ratio of GEV and NGEV reflects flexibility. Participants performed point-to-point movements over obstacles that differed in height from 5-9cm and from 11-15cm to enlarge the range joint angle configurations used. In the test condition the

obstacle was 10cm high and which was presented before, and during or after the manipulation. Before we tested the effect of the manipulation after practice we checked whether manipulating the range of joint angle configurations used increases the variability of the test condition during the manipulation of 150 trials. We found a larger joint angle variability (i.e., increase in GEV and NGEV) during the manipulation compared to before. So the manipulation led to an increase in variability during the manipulation. We increased the amount of manipulation trials to create a practice phase (600 trials). We investigated whether practice resulted in a larger flexibility after practice. The results showed significantly less GEV and a trend of less NGEV after the manipulation, whereas flexibility was not affected. Taken together, these results indicated that joint angle variability increased during the manipulation, however, this did not result in an increase in flexibility and variability after practice.

Bandwidth feedback improves consistency on the learning of a motor skill

Ugrinowitsch, Alessandra AC., Centro Universitario Belo Horizonte; Azevedo, Bruna FM., Centro Universitario belo Horizonte; Silva, Miriam M., Centro Universitario Belo Horizonte; Lima, Thiago M., Centro Universitario Belo Horizonte

Bandwidth feedback improves motor skill acquisition. One hypothesis is that when performance is inside the bandwidth no feedback is provided and there is no necessity of changing of the action plan. Consequently, performance on learning test becomes more consistent. Whether this hypothesis is correct, the bandwidth feedback should improves motor consistency but not motor accuracy. The aim of this study was to test the consistency hypothesis for explaining the effects of the bandwidth feedback on the acquisition of a motor skill. Thirty university students participated as volunteers on this study and they were divided randomly into 15% bandwidth group (G15%) and no bandwidth group (G0%). The task consisted of pressing the Keys 2, 4, 8, 6 of a numerical keyboard in this specific sequence using the index finger, with the goal of completing the task under the target time of 900 ms. The G15% received feedback only if absolute error was higher than 15% in relation to the target time and the G0% received feedback in every trial. The experiment consisted of acquisition phase with 60 trials and retention test performed 24 hours later with 10 trials. The two way ANOVA adopted during acquisition phase showed that both groups improved similarly performance accuracy. However, G15% had higher consistency than G0% as well as received small amount of feedback. The student t test adopted during retention test showed that both groups had similar accuracy. However, once more G15% had higher consistency than G0%. In conclusion, the lower performance variability presented during acquisition phase was repeated on retention test, indicating that the small amount of feedback provided during acquisition phase conducts to small amount of changes of the action plan and more consistent learning. At last, these results corroborate the consistency hypothesis as an explanation for the effects of the bandwidth feedback during the learning of a motor skill.

Effects of practice schedule on the learning of structure and parameters of the volleyball tennis serve.

Ugrinowitsch, Herbert, Crus, Madson P., Benda, Rodolfo N., Vieira, Marcio M., Lage, Guilherme M., Silva, Patrick CR., Neves, Thiago F., Universidade Federal de Minas Gerais

The practice schedule lab studies have shown that constant practice helps to learn the movement structure and variable practice helps to learn movement parameterization. The studies used a simple task of pressing four numeric keys in a computer keyboard. However, it was not found studies that investigate this question with complex sport skill such as the volleyball tennis serve. The aim of this study was to compare the effects of constant practice and random practice on the learning of the volleyball tennis serve and analyze its effects on the learning of the movement structure (i.e., movement pattern) and parameterization (i.e., score accuracy). The experiment consisted of pre-test, acquisition phase and retention test. The sample consisted of 20 children between 10 and 12 years without experience in the task, which was divided in random group (RG) and constant group (CG) after flatness by performance of the serve score in the pre-test. Before starting the experiment all participants could watch one video with an expert performing the volleyball tennis serve for five times. The acquisition phase was divided into six sessions with 42 serves each session was held one session per day. The RG practiced the task from three different positions in the court, always indicated at the end of each serve. The CG practiced the task only from one position. Two days after acquisition phase it was performed the retention test in the same conditions than pre-test, with 15 trials. Data analysis was run by two way ANOVA comparing the movement pattern and score of the two groups during pre-test and retention test. The results showed that both groups improved the structure of the movement

during the experiment. Moreover, random practice showed higher accuracy than constant practice even with higher variability. In conclusion, both practice schedules improved the movement pattern but random practice improved parameterization ability, showing that practice schedule has different effects over complex sport skill.

Gaze strategies in peripheral motion detection: On the superiority of anchoring over tracking
Vater, Christian, Klostermann, Andre, Hossner, Ernst-Joachim, University of Bern

In team sports, players either use fixations or smooth pursuit eye movements (SPEM) to process information. It is generally accepted that anchoring gaze helps to optimally use peripheral vision while it is completely unknown whether the same is true for SPEM. Therefore, peripheral motion change detection was examined by contrasting a fixation condition with a SPEM condition. For this purpose, 13 participants were confronted with a visual display consisting of 15 white squares and 1 red square and instructed to follow the red square with their eyes and to press a button as soon as a white square begins to move. White square movements of 500 ms duration occurred when the red square either stood still (fixation condition) or was moving in a circular manner with 6 "/s (pursuit condition). The to-be-detected white square movements varied in eccentricity (4", 8", 16") and speed (1"/s, 2"/s, 4"/s). A Vicon-integrated eye-tracking system was used for controlling gaze behavior. Response times (ms) and missed detections (%) were measured as dependent variables. Results show that peripheral motion changes are detected faster in the fixation compared with the SPEM condition (401 ms vs. 809 ms) and that response times increase as a function of eccentricity in the SPEM condition only (4": 570 ms; 8": 737 ms; 16": 1121 ms). Moreover, 36% of the motion changes were missed at 16" eccentricity in the SPEM condition (fixation condition and 4"/ 8" SPEM condition: < 2% missed events). In a follow-up experiment, the same results were obtained when participants had to follow a virtual center of 4 red squares rather than a red square showing that SPEM as such and not foveal processing caused the eccentricity effects. In sum, it could be shown that SPEM impair the ability to detect peripheral motion changes. Thus, anchoring gaze is advisable if peripheral changes (e.g. movements of players) have to be detected and fast reactions are required.

The cognitive representation of complex actions in work processes: A technological approach for individual diagnostic in people with cognitive disabilities
Vogel, Ludwig, Bielefeld University; Schack, Thomas, Bielelfeld University

Mental representations built the cognitive basis in the organization and control of actions. To act meaningful and goal-oriented, actions and their representation should be organized task-depended in a functional manner. However, oftentimes people with cognitive disabilities have problems to fulfill working-tasks autonomous and self-organized. In this study, we investigated the cognitive representation of complex actions in work processes in trainees with cognitive disabilities and compared them to their instructors. Therefore, we applied a psychometric measurement method. The trainees were mentally handicapped employees in a vocational training program that prepares handicapped individuals to participate in workplaces. We found significant differences in the cognitive representations of the work processes between the instructors and the trainees. Instructors showed task-specific cognitive structure with well-structured representation of task specific actions, whereas trainees exposed less functional structure representations. Based on these results we will present solutions for individual cognitive training. With this study we could show that it is possible to measure the cognitive structure of complex actions in people with cognitive disabilities and provide individual feedback for learning processes.*—This research/work was supported by the Cluster of Excellence Cognitive Interaction Technology 'CITEC' (EXC 277) at Bielefeld University, which is funded by the German Research Foundation (DFG)*

Target width scaling in unimanual and bimanual aiming tasks
Wang, Chaoyi, Shea, Charles H., Texas A&M University

A relatively large number of studies have used kinematic measures to infer how changes in the ID (Fitts, 1954) of unimanual aiming movements influence the control processes used to produce the desired movement with different control processes used in lower and higher IDs movements (e.g., Buchanan, Park, & Shea, 2006; Guiard, 1993, 1997; Mottet & Bootsma, 1999). To further these findings, unimanual and bimanual reciprocal aiming tasks, constructed with different IDs (ID=3, 4, 5, and 6), were tested to determine if the control strategies used to perform

unimanual aiming tasks are similar to those used in bimanual aiming tasks. Each participant was assigned to either a bimanual (N=8) or unimanual condition (N=8). Participants were asked to move a cursor by extending and flexing their limb as quickly and accurately as possible between the two targets presented in a Lissajous display. Note that in the Lissajous display left limb movement would move the cursor up (extension) and down (flexion) while movement of the right limb would move the cursor left (flexion) and right (extension). In the bimanual condition a 1:1 in-phase coordination could be used to achieve the targets. Participants practiced 2 trials at the four IDs (8 total trials) either in the increasing or decreasing ID order (order counter-balanced). Each trial was 30s. The results indicated that, as ID increased, the end-effectors' motion gradually switched from cyclical motion to discrete motion for both unimanual and bimanual aiming tasks. However, the transition in control strategy occurred earlier for the bimanual than the unimanual aiming task. Results also indicated bimanual aiming task was performed slower and was more variable than the unimanual task at ID6 as a result of the increase in dwell time, but no differences in performance were detected between the two tasks at lower IDs.—*CEHD Strategic Research Fellowship at Texas A&M University*

Choosing a coordination (bimanual or unimanual) strategy

Wang, Chaoyi, Shea, Charles H., Texas A&M University

Two tasks (A,B) were designed which required participants to sequentially move through four target positions in a Lissajous display. Task A was designed so that the participant could complete the task using either unimanual or bimanual control strategies. Task B was designed so that participants could complete the task using relatively simple or more complex bimanual control strategies. Although the bimanual coordination literature suggests that participants tend to choose more stable coordination patterns over less stable patterns (Haken, Kelso, & Bunz, 1985; Schoner, Haken, & Kelso, 1986; Schoner & Kelso, 1988, Fontaine et al., 1997; Zanone & Kelso, 1992), there is little literature which tests a performer's preference when facing a choice of control strategies. The purpose of this study was to determine which control strategy the participant will choose to complete the two tasks and determine the degree to which the size of the targets influences the control strategy chosen. Both tasks required participants to move a cursor in a Lissajous display sequentially through four targets as fast and accurately as possible. The amplitude (A) between two adjacent targets and the target size (W) resulted in an Index of Difficulty (ID) of 2 and 4 (ID=log2 (2A/W), Fitts, 1954) for each task. For both tasks, participants (N=8) practiced 15 trials (30s per trial) for each ID and then a test trial was administered. The results for both Task A and B indicated that the ID2 condition resulted in a circular path while ID4 condition resulted in straight-line paths on the Lissajous plot. This suggests that at the low ID condition participants produced a continuous 90 degree bimanual coordination pattern. At the high ID condition, the participants consistently chose to switch between more stable unimanual left and right movements in Task A and to perform a discrete 90 degree bimanual coordination pattern in Task B. In addition, both limbs' movements were more harmonic in the low ID condition than the high ID condition.

An internal focus of attention during exercise can influence anxiety in Parkinson's disease

Wang, Mary Y., Movement Disorders Research & Rehabilitation Centre; Beck, Eric N., Movement Disorders Research and Rehabilitation Centre, Wilfrid Laurier University; Ehgoetz Martens, Kaylena A., University of Sydney; Almeida, Quincy J., Movement Disorders Research and Rehabilitation Centre, Wilfrid Laurier University

Anxiety in Parkinson’s disease (PD) has been linked to gait impairments. Fear of falling related to one’s gait might contribute to greater anxiety in PD. This anxiety may necessitate more attention to gait. If one were able to improve gait automaticity by using goal-based exercise, less attentional resources might be needed to reinvest into gait, and reduce anxiety. Fostering an external focus of attention (EFA) may stimulate more automatic movement control, whereas promoting an internal focus of attention (IFA) might be less effective at improving movement automaticity. Therefore, the current study aimed to investigate whether goal-based exercise that promotes either an EFA or IFA might improve anxiety in PD. PD participants (N=27) performed 33 1-hr sessions of goal-based exercise over 11 weeks. Participants were randomized into two groups: i) EFA exercise (n=12, attention towards movement of stickers), or ii) IFA exercise (attention towards limb movements. To measure anxiety regarding movement and reinvestment of attention to gait, a Parkinson Anxiety Scale (PAS) and a Movement Specific Reinvestment scale (MSRS) were administered before and after the exercise program. Participants also used self-assessment manikins (SAMs) to evaluate their anxiety while performing single and dual-task 10m walking trials. Spatiotemporal gait

parameters were also collected. For the PAS and MSRS, significant interactions between time and group demonstrated that the IFA group experienced less anxiety ($p<0.01$) and reinvestment ($p=0.03$) at post compared to pre. In contrast, the EFA group felt significantly more anxious while walking after intervention ($p<0.01$), revealed by a time and group interaction for SAMs. Dual task cost increased only in the EFA group. Opposing our hypothesis, the IFA group had lower self-perceived anxiety and evaluated their movements less at post, whereas perceived anxiety while walking increased in the EFA group. Thus, training an IFA in PD may improve comfort with movement, decreasing anxiety and the tendency to reinvest attentional resources to walking.

The effect of fractal gait synchronization on cardiolocomotor coupling in younger and older healthy adults

Wittstein, Matthew W., Elon University; Starobin, Joseph M., Schmitz, Randy J., Shultz, Sandra J., Haran, Francis J., Rhea, Christopher K., University of North Carolina at Greensboro

Aging and pathology result in alterations to the normal rhythms of physiological function. The cardiac and locomotor systems share both structural and functional components; thus, their behaviors are inevitably coupled. Previously, cardiolocomotor coupling has been suggested by evidence of concurrent changes in each system individually. Now, advances in mathematical methods allow the direct measurement of coupling between separate physiological rhythms. This study used cross recurrence quantification analysis to measure the cardiolocomotor coupling while walking on a treadmill in three 15 minute phase (in order): (1) without a stimulus (pre-sync), (2) synchronizing to a visual metronome containing fractal patterns (sync), and (3) without a stimulus (post-sync). Healthy, physically active participants (N=25 younger, 24.57"4.29 yrs; N=26 older, 67.67"4.70 yrs) were recruited from a university student population and regional activity groups. Electrocardiogram and lower limb kinematics were used to create time series of R-R intervals and stride time intervals while walking to record cardiac and locomotor behaviors, respectively. Coupling was defined as the shared patterns of these behaviors examined over several time lags. A two way (age group x phase) repeated measures ANOVA identified a main effect for phase (F1.81, 88.75=3.59, $p=0.036$) but no interaction effect (F1.81, 88.75=1.47, $p=0.237$). Both groups demonstrated more coupling during the sync phase compared to the pre-sync phase. Coupling returned to pre- sync values during the post-sync phase. This study demonstrated the extent to which cardiolocomotor coupling differs when a walking constraint is imposed. Cardiolocomotor coupling (and other couplings) may indicate subtle changes in function associated with task demands. Thus, coupling could potentially be used to understand how aging and pathology impose constraints across physiological systems leading to new innovative treatments and rehabilitation techniques.

Using a novel postural assessment device to detect balance deficits following mild traumatic brain injury

Wright, W. Geoff; Temple University

Traumatic brain injury (TBI) affects over 2 million people per year in the US. The largest percentage are mild TBI (mTBI), i.e. concussion, and can occur following a head impact or exposure to a bomb blast wave. Though not usually life-threatening, the effects may be serious, and symptoms often include headache, cognitive deficits, blurry vision, dizziness, and postural deficits. Because balance impairment is a common sensorimotor sequelae of mTBI, we designed a portable virtual reality (VR)-based balance screening device to determine if the new device can replace existing tools that are prohibitively expensive or lack sensitivity or specificity. In the current study, we performed reliability measures and concurrent and known-groups validity measures of the device relative to the Neurocom Sensory Organization Test (SOT). Healthy adults (n=56) and adults with mTBI (n=11) performed the SOT and six upright postural tasks on the new balance device. The six conditions included standing on a Wii Balance Board (WBB) with or without a foam pad while center-of-pressure data was collected during three visual conditions: Static, Dark, and Dynamic Scene (Roll at 60"/s). Intra-class correlations (2-way mixed-model, absolute agreement) revealed very good test-retest reliability of the new device (ICC=0.88) and excellent concurrent validity with the Neurocom force plate (ICC2,1 = 0.901-0.995). Individuals with mTBI performed significantly worse than the healthys on the new device ($p=0.001$), which had 91.0% accuracy and an ROC curve with a significant area-under-the-curve (AUC=0.865, $p<0.001$). Conditions with dynamic visual stimulation were the most sensitive to health status. The SOT had an 84.8% accuracy and AUC=0.703 ($p=0.034$). The new VR-based device is a reliable tool and valid measure for detecting balance impairment following mTBI, which suggests it can potentially replace more expensive and cumbersome equipment. Assessments that test visual-vestibular processing increase sensitivity to mTBI-related balance deficits, which can be used to guide rehabilitation.

Lassoing positive affect and motor learning through choice

Wulf, Gabriele; Machin, Brittney, Kellogg, Jessica, Copeland, Clint, University of Nevada, Las Vegas; Lewthwaite, Rebecca, Rancho Los Amigos National Rehabilitation Center; Iwatsuki, Takehiro, University of Nevada, Las Vegas

According to the OPTIMAL theory of motor learning (Wulf & Lewthwaite, 2016), a key factor for optimal learning is learner autonomy. Autonomy support can be achieved by giving learners choices, including ones that are incidental to task performance. In the present study, we sought to provide further evidence that incidental choices would enhance motor skill learning (see Lewthwaite, Chiviacowsky, Drews, & Wulf, 2015). In addition, we wanted to assess learners' affective responses as a function of having versus not having choices during practice of a novel task. Two groups of participants practiced a novel task, throwing a lasso. After a pre-test, one group (choice group) was able to select the color of a mat (blue, green, or pink) to be placed under a cone that served as the target before each upcoming block of 3 practice trials. Yoked control group participants were provided with the same colored mats their choice-group counterparts had selected. On a retention test (white mat) one day later, the choice group's throwing accuracy was significantly higher than that of the yoked group. The choice group also reported more positive affect following the practice phase and before the retention test compared with the yoked group. Moreover, affect predicted learning (i.e., retention performance). The positive affective consequences of even incidental choice are consistent with the perspective that choice is experienced as (intrinsically) rewarding, a condition – when paired with practice – that is hypothesized to potentiate motor learning through dopaminergic means.

Optimizing performance Through ntrinsic Motivation and Attention for Learning: The OPTIMAL theory of motor learning

Wulf, Gabriele, University of Las Vegas, Nevada; Lewthwaite, Rebecca, Rancho Los Amigos National Rehabilitation Center; University of Southern California

Effective motor performance is important for surviving and thriving, and skilled movement is critical in many activities. Existing theoretical perspectives do not accommodate significant recent lines of evidence demonstrating motivational and attentional effects on performance and learning. This evidence includes research on (a) conditions that enhance expectancies for future performance, (b) variables that influence learners' autonomy, and (c) an external focus of attention on the intended movement effect. We introduce a new theory of motor learning: The OPTIMAL (Optimizing Performance through Intrinsic Motivation and Attention for Learning) theory. The theory proposes that motivational and attentional factors contribute to performance and learning by strengthening the coupling of goals to actions. It provides explanations for the performance and learning advantages of these variables on psychological and neuroscientific grounds. The theory describes a plausible mechanism for expectancy effects rooted in responses of dopamine to the anticipation of positive experience and temporally associated with skill practice. Learner autonomy is assumed to act largely through an enhanced expectancy pathway. Further, both enhanced expectancies and an external attentional focus are seen as important for the establishment of efficient functional connections across brain networks that subserve skilled movement. Enhanced expectancies and an external focus propel performers' cognitive and motor systems in productive "forward" directions and prevent "backsliding" into self- and non-task focused states. Expected success breeds further success and helps consolidate memories. Key tenets of the OPTIMAL theory are highlighted and implications discussed.

The eye movements and reaction time of handball players in a fast break situation

Yuuki, Mizusaki, Yukio, Yamaguchi, Fukuoka University

In ball sports, fast breaks occur frequently. Numerous studies have demonstrated that gaze behavior is critical in quick reactions. Therefore, gaze behavior should also be important in reacting to fast breaks. However, fast breaks have received little research attention. This research examined the relationship between visual search strategy and reaction time to fast breaks in handball. The visual search strategy and reaction times of regular players (n = 18) and non-regular players (n = 19) were measured. The participants viewed a video of a three-on-three game situation that was taken from each position (side, 45", center) from the defense's perspective. The video consisted of 20 scenes, among which 14 scenes were miss situations leading to fast breaks, whereas the remaining 6 scenes were successful offensive situations. Gaze behavior was analyzed from various perspectives (side, 45", center, space1: between the center and 45", space2: between 45" and side, ball) when the participants viewed miss scenes. Reaction times were

measured as the depression of the foot at the moment play switched to a fast break. As a result, the visual fixation time for the two spaces (i.e., space1 and space2) in regular players was longer than in non-regular players before fast breaks occurred. Further, regular players reacted to switch a fast break faster than non-regular players. We suggest that regular players can focus their visual attention on the spaces between opponents to predict fast breaks. This study may contribute to raising the success rate of fast breaks.

Feedback valence shows dissociative effects on automaticity and precision in motor learning

Zobe, Christina, Krause, Daniel, Paderborn University; Blischke, Klaus, Saarland University

With progressive practice, motor skill performance improves and conscious attentional demands decrease, i.e. the skill automatizes. Error information tends to improve performance, but may disrupt automatization depending on perceived feedback valence (i.e. positive or negative). We expected positive feedback valence to improve performance precision (Lewthwaite & Wulf, 2010), and to stimulate skill automatization (operationalized as dual-task cost reduction). These hypotheses were tested on 56 participants practicing a four-element elbow-extension-flexion-sequence (720 trials). They had to execute this task within a time limit of 1200 ms as precisely as possible. Movement precision was defined as mean absolute error regarding the reversal points (70", 20", and 70"). Dual-task costs were assessed according to the secondary-task paradigm with an n-back task (primary-task prioritized). Error feedback was provided on 14% of the trials (substantially higher feedback frequencies have proven detrimental to motor automatization; Krause et al., 2016). Feedback valence was induced by normative feedback: systematically manipulated reference lines in a visual feedback display indicated performance of a putative peer-group either to be superior (negative-valence-group) or inferior (positive-valence-group) to participants' actual performance. To control for task integration as an alternative explanation for dual-task cost reduction, a control-group (no practice) was included, and a neutral-valence-group (no reference lines) was conducted to check possible valence-induced effects. Results: Dual-task costs (n-back error) significantly decreased only in the positive-valence-group, $p = .003$, $eta^2 = .51$, but in no other group, $p > .431$. Mean absolute error (motor task) significantly decreased (i.e. precision increased) only in the negative-valence-group, $p = .010$, $eta^2 = .41$, but in no other group, $p > .477$. Thus positive feedback valence appears to enhance skill automatization as predicted, while "unexpectedly" only negative feedback valence seems to improve movement precision.

Motor Development

3-month-old infants continue to step in the air when stepping on a surface has waned

Anderson, David I., San Francisco State University; Provasi, Joelle, Ecole Pratique des Hautes Etudes; Barbu-Roth, Marianne, Paris Descartes University

Recent experiments have shown that 2-month-old infants make significantly more stepping movements when held upright in the air than when held upright on a surface. Unlike newborns, however, air stepping in 2-month-old infants is not facilitated by optic flows that move toward or away from the infant. The current experiment examined whether the same pattern of findings seen in 2-month-olds would be seen in 3-month-olds. Video data were collected on 18 infants (6 males, 12 females, mean age = 98 days) in three air stepping conditions and one tactile stepping condition: air stepping while exposed to a static (STATIC), approaching (TOWARD), or receding (AWAY) checkerboard pattern of black squares on a white background and stepping forward on a table (TACTILE) with a plain white surface. Each condition was tested for one minute. The results revealed a significant difference in the total number of steps taken in each condition, $F(3, 17) = 6.9$, $p < .05$. Follow-up simple main effects tests revealed that significantly fewer steps were taken in the TACTILE condition (8.6) than the STATIC (19.4), TOWARD (17.6), and AWAY (19.7) air stepping conditions, which were not significantly different from each other. No differences were found across conditions in the number of steps taken with the left or right leg, in the latency to initiate the first step, or in the amount of crying. These findings further challenge the widely-accepted idea that upright stepping declines around two months of age because the infants' legs become too heavy to lift.—*ANR-11-BSH2-007 01, NeRF 2009.46, HD050638*

The impact of congenital v. acquired visual impairments of physical activity participation among adults

Brian, Ali S., University of South Carolina; Haegele, Justin A., Old Dominion University; Lieberman, Lauren J., The College at Brockport

Individuals with visual impairments (VI) tend to report lower physical activity levels than peers without VI. Given the breadth of evidence to support the association between physical activity and health enhancing outcomes, it is essential to understand what factors influence physical activity engagement for those with VI. Previous research has not explored differences in physical activity by onset (congenital vs. acquired VI) and gender. Therefore, the purpose of this study was to investigate the associations amongst onset of VI and gender with levels of physical activity (METs) and sedentary behavior (sitting time). Participants (N=92; females=50) ages 18-77 (M=46.88, SD=13.91) completed a demographic questionnaire and the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Results of a 2 (onset) x 3 (VI classification) x 2 (gender) ANOVA on METs demonstrate significant main effects for gender ($F = 4.887$, $p=.030$, partial eta squared=.06), VI ($F = 4.708$, $p=.012$, partial eta squared=.11), but not onset ($p=.567$). There was a significant interaction between gender and onset ($F=5.100$, $p=.027$, partial eta squared=.06) but not gender and VI classification ($p=.444$). Post hoc analyses show that females who were born with VI demonstrate significantly higher METs (M=9457, SD=1383, $p<.001$) than females who acquired VI later in life (M=5346, SD=1110) regardless of VI classification. There were no significant differences in METs for males by onset ($p=.203$). In regards to sedentary behavior, results of an additional 2 (onset) x 3 (VI classification) x 2 (gender) ANOVA demonstrated significant main effects for gender ($F=5.457$, $p=.022$, partial eta squared=.06), but not for VI ($p=.914$) or onset ($p=.426$). There were no significant interactions for gender with either VI ($p=.715$) or onset ($p=.640$) in regards to sedentary time. Therefore, females who were born with a VI were more active and less sedentary than any participant who acquired VI later in life.

The effects of physical activity on physical fitness among children with Intellectual and Developmental Disabilities

Collins, Kyla J., Staples, Kerri L., University of Regina

INTRODUCTION. In Canada, one in three children are considered overweight or obese. Children with intellectual and developmental disabilities (IDD) are at an even greater risk for obesity and have an increased prevalence of obesity-related health conditions than their typically developing peers. Decreased levels of physical activity and low physical fitness levels found among children with IDD may contribute to this rise in obesity. Because children with IDD are at an increased risk of diseases related to movement, such as obesity, it is important to have adequate health-related physical fitness in order to be able to complete activities of daily living and lower these health risks. METHODS. The focus of this research is on improving the performance of physical fitness components through physical activity among a group of 7 to 12 year old children with IDD who participated in a 15-hour physical activity program. These athletes are diagnosed with ASD, Down syndrome, global developmental delay, or fetal alcohol spectrum disorder. The Brockport Physical Fitness Test was used to assess levels of health related physical fitness of 30 athletes (20 boys, 10 girls) before participation and following the program. RESULTS. The results of paired samples t-tests showed participation in 15- hour physical activity program can significantly increase aerobic capacity and muscular strength and endurance in children with IDD. CONCLUSIONS. This presentation is aimed at understanding the role of physical activity and sport-based programs in helping children with IDD to develop the fitness capacities essential to participation in a wide variety of activities.

Jumping from heights: Children's perception of a jump affordance from a platform to the ground

Cordovil, Rita, Pascoal, Joana, Burnay, Carolina, Faculdade de Motricidade Humana, Universidade de Lisboa

Depth perception appears quite early in our development. Soon after crawling, infants increase their tendency to avoid visual and real cliffs. As children grow, they start exploring different environments, often testing their action capabilities in risk situations, such as jumping from heights. This study examined the influence of age, anthropometric characteristics, observation point and motor competence in the perception and action of a drop jump task from a platform to the ground. Children between 5 and 10 years of age (n=91) were asked to estimate their maximum jump height before it was actually measured. Their anthropometric measures were taken and the motor competence of a smaller sample (n=75) was evaluated using the K"rperkoordinationstest F"r Kinder (KTK) (Kiphard, & Schilling, 1974). The results indicated that: maximum jump height was overestimated from the ground (81.3% overestimations) and underestimated from the top (69.2% underestimations); children with better motor competence were more accurate than their peers when predicting their maximum jump height from the ground (20% vs. 0% accurate estimations); error magnitude from the ground was mainly influenced by age and motor competence (R2=.23), but none of the tested variables influenced error magnitude from the top; maximum jump height was mainly explained by age (R2=.41); sitting height and sex were the best predictors for the estimation from the ground (R2=.37) and age was the best predictor for the estimation from the top (R2=.39). When an intrinsic measure (cf. Warren, 1994) was considered, we found that most children (short or tall) estimated their maximum jump height at 1.49 of their height in the ground estimation, and at 1.06 of their height in the top estimation. The maximum jump height was at 1.21 of the small group’s height and at 1.27 of the tall group’s height. The knowledge of the perceptual category boundary between the "jumpable" and "not jumpable" drop jump height has important implications in terms of child safety.

Impact of adiposity on postural control at the onset of sitting

Dinkel, Danae, UNO; Kyvelidou, Anastasia, Senderling, Ben, Snyder, Kailey, Lee, Jung-Min, University of Nebraska at Omaha

Sitting is one of the key motor milestones in the first year of life, which changes the way infants interact with the world. Unfortunately, adiposity has been associated with delayed motor development. However, little research has examined the impact of infant adiposity on the quality of gross motor behavior, especially in sitting through measuring postural control. Therefore, the purpose of this study was to examine the impact of adiposity as measured by skinfold thickness (SFT) on postural control at the onset of sitting in typically developing infants. Nineteen infants (n=8 high SFT, n=11 lower SFT) participated in a pilot study examining the relationship between infant

physical activity and postural control. High SFT was classified as having a subscapular and triceps measurement in the 85th percentile or above according to the WHO age and sex- specific standards. Infant's postural control was measured within one week of the onset of sitting. Three trials of sitting were recorded while infants were sitting on an AMTI force platform and postural sway measures were recorded. Sway movement patterns were analyzed using the root mean square (RMS) and range for both the anterior/posterior (AP) and medial/lateral (ML) direction as well as sway path. The results revealed that there were no significant differences between infants in the RMS and Range in the AP and ML directions. However, Sway Path was significantly different between the two groups of infants. Specifically, infants with high SFT showed lower Sway Path values in comparison to lower SFT infants. These results suggest that infants with high SFT cover significantly less distance with their center of pressure and overall move less than infants with lower SFT. This finding may suggest that infants with more adiposity adopt a different postural control strategy, due to the added mechanical constraints imposed by the added SFT. This altered strategy, may limit exploration early in development, which may hinder the progression of cognitive emotional and social processes, however more research is needed.—*COBRE P20GM109090; National Institute Of General Medical Sciences of the National Institutes of Health*

Healthy children in aound communities - A longitudinal intervention project in primary schools to prevent obesity

Dreiskaemper, Dennis, University of Muenster, Germany; Utesch, Till, Naul, Roland, University of Muenster

Stodden et al. (2008) argue that the relationship between motor competence (MC), perception of motor competence and health related fitness are the key factors to predict physical activity of children. Based on this theory and the socio-ecological model by Sallis (2008), the aim of this intervention study was to implement a strategy to promote a healthy lifestyle in order to counteract an increase of motor deficits and obesity in elementary school children. A weekly schedule including curricular and non-curricular physical and health education lessons was established (Naul et. al, 2012). In four cohorts 1212 German and 733 Dutch children participated in the project. Children took part annually in a (product-oriented) MC-test including BMI and completed surveys about life-quality, media consume, physical activity, physical self-concept and class-climate. Parents filled out a questionnaire about nutrition and physical activity twice. Instead of a control group, MC data was compared with German national reference norms (quintiles). Hereby children of each cohort showed a significant higher level of performance in five (cohorts 1 and 3) and seven (cohort 2) of seven motor tests. Up to 30% of children that were obese starting the intervention dropped from the highest BMI level during four-year intervention. Significant changes for media screen time, parents` behavior and attitudes, and physical activity (e.g., school way) were shown. Intrapersonal analysis showed high stability of physical self-concept and group climate being significantly correlated with BMI and motor skills. A SEM indicates that the perception of own motor skills mediates the relation between motor skills and physical activity. The results underline the impact of community-based intervention programs including socio-psychological factors (e.g., physical self-concept, well-being). Not only MC and BMI were affected by the program. Also, social and intra-individual factors were increased due to the intervention program. Further studies are needed to confirm the results.

Measuring perceived motor competence and physical self-concept of children: An analysis of different approaches to measure self-perception in early childhood

Dreiskaemper, Dennis, Tietjens, Maike, University of Muenster, Germany; Schott, Nadja, University of Stuttgart, Germany; Barnett, Lisa, Deakin University

Stodden at al. (2008) conceptualized the relationship of motor skill competence (MC), perception of MC and health related fitness (HRF) as being important to predict physical activity (PA) of children. Perceived HRF may also have an impact on PA in childhood. The perception of MC in young children can be measured by the PMSC (Barnett et al., 2015). The physical self-description questionnaire (Marsh et al., 1990) includes perceived HRF and as a further factor attractiveness. One key research question for motor development in childhood is, which type of physical self-perception (MC or HRF) is appropriate in predicting PA in children. Therefore, the aims of this study were to develop a German translation of the pictorial scale for perceived MC, to develop a corresponding scale for perceived HRF (ISPSC) and to test the relation between these. Three pilot studies were conducted. In study one (n = 68, 7-10ys., male 56%), a German version of the PMSC showed no problems with face validity of the single items,

although it became obvious that the skills "hitting a ball" and "paddling with a board" were not familiar for German children. Internal consistency was acceptable (locomotion α = .71, object control α = .79). Exploratory factor analysis confirmed the two independent scales as well as good item-scale correlations. In study two (n = 131, 4-7ys., male: 51%), the ISPSC with its eight items (seven for HRF, one for attractiveness) showed good face validity and internal consistency (α = .73). In study three (n = 71, 7-10ys., male 45%) results show high correlations between the scales of the PMSC and ISPSC (with locomotion r = .68, with object control r = .65). In conclusion, the pilot studies show that measuring not only the perception of own motor skills but also the perceived HRF in early childhood is possible - and that they don"t measure the same thing. Further studies will focus on the predictability of PA, but also of psychological factors like well-being or cognitive functions by measuring the self-perception of children.

Motor skills and physical activity in 18 month-olds

Felzer-Kim, Isabella T., Michigan State University; Hauck, Janet L., Michigan State University

Introduction: During the first years of life, levels of physical activity (PA) are highly variable between children, with some producing greater PA than others. Given this variability, it is of value to investigate potential benefits of increased PA in early life. Still, little is known regarding the influence of PA on health and developmental outcomes in childhood. The purpose of this study was to evaluate the relationship between PA and motor development at 18 months of age. Method: Level of PA and motor skill development were assessed in 20 toddlers aged 18 months. PA was assessed using an Actigraph accelerometer placed at the waist and validated cut points were applied. Data were expressed as minutes per day of sedentary, light, and moderate intensity PA. Motor skill development was assessed using the Bayley Scales of Infant Development-3rd edition. The statistical relationship between PA and motor skill development was assessed using partial correlations controlling for gender. Results: Greater gross motor skill development is significantly correlated with fewer minutes per day of sedentary PA (r = -.602, p = .011) and light PA (r = -.538, p = .026). Fine motor skill development was not significantly related to level of PA. Conclusion: At 18 months of age, children who spend less time per day in sedentary or light PA have greater gross motor skill development than those who are more sedentary. This relationship is well described in preschoolers, but evidence of this association emerging earlier in life is novel. This knowledge should generate research exploring the manipulation of PA and motor skill acquisition in children under two years of age as well as establishing causality. This finding has implications for the influence of toddler PA on motor skill development and early onset of obesity.

Motor variability in development: Exploring task solutions

Golenia, Laura, Schoemaker, Marina M., Mouton, Leonora J., Bongers, Raoul M., University of Groningen

To understand how action capabilities develop it is important to understand how children explore their possibilities for goal-directed actions. We argue that exploration is the variability in actions resulting from the search for a solution space of a task: Take the task of making an aiming movement with the index finger. The joints in the arm make up the joint space. A part of that joint space is the solution space for that task, that is, the joint angle combinations bringing the index finger to a certain position. We study how exploration to search for the solution space develops in school-aged children. Thirty-eight children (6, 8 and 10 years of age) and 15 adults performed goal-directed aiming movements to targets in front of them. The UCM method was used to partition variability in joint angles of the arm in exploration within the solution space and in exploration outside the solution space. We found that all participants had more exploration within the solution space compared to exploration outside the solution space. The amount of exploration changed over age: both types of exploration decreased as a function of age. These findings show that variability in actions is the result of different types of exploration and that both types of exploration decrease with age. The current approach revealed developmental trends in different types of exploratory behavior. We will discuss how advancing this approach will help understanding the origins of development of new behaviors.—*University of Groningen*

The relationship of school readiness and motor skill performance of low SES Hispanic preschool children

Hamilton, Michelle L., Liu, Ting, Montes, Jennifer, Texas State University

Acquisition of basic conceptual and motor skills is strongly related to school readiness in preschool children (Heckman, Stixrud, & Uzura, 2006). The development of these fundamental skills are essential to their early childhood progression. The purpose of this study was to examine the relationship of school readiness and fundamental motor performance of low SES Hispanic preschool children. One hundred and fifteen low SES Hispanic preschool children (52 female, 63 male) participated in this study. The Peabody Developmental Motor Scales-2 (PDMS-2; Folio & Fewell, 2000) was used to assess preschoolers' fine and gross motor performance and the Bracken Basic Concept Scale-III (BBCS-III, Bracken, 2006) was used to examine their school readiness and basic conceptual skills. PDMS-2 raw scores were converted to fine, gross, and total motor quotient scores (i.e., FMQ, GMQ, TMQ). The BBCS-III raw scores were converted to standard scores for each subtest (i.e., school readiness, direction/position, self/social awareness, texture/material, quantity, and time/sequence). A Pearson correlation was used to evaluate the relationship between PDMS-2 FMQ, GMQ, TMQ and BBCS-III standard sores of 6 subtests. Resulted indicated that PDMS-2's FMQ had significant positive correlations with BBCS-III's school readiness, $r(113) = .235$, $p < .05$, and direction/position, $r(113) = .256$, $p < .01$. PDMS-2's GMQ was also significantly related to BBCS-III's school readiness, $r(113) = .226$, $p < .05$, and direction/position, $r(113) = .256$, $p < .01$. Furthermore, PDMS-2's TMQ showed a significant positive correlation with BBCS-III's school readiness $r(113) = .269$, $p < .01$, direction/position, $r(113) = .347$, $p < .01$, texture/material, $r(113) = .186$, $p < .05$, quantity, $r(113) = .203$ $p < .05$, and time/sequence, $r(113) = .218$ $p < .05$. These findings suggested that low SES Hispanic preschool children who demonstrated better fundamental motor skills on PDMS-2 tend to perform well in school.

Integrating core curriculum with basic movement skills in elementary physical education

Hollett, Nikki L., Auburn University; Sluder, Brandon J., Troy University; Taunton, Sally, University of South Carolina; Brock, Sheri J., Auburn University

By integrating general subjects into elementary school physical education lessons, students are able to improve their cognitive, psychomotor, and affective learning domains (Pica & Short, 1999). This all-inclusive approach promotes higher autonomous learning from the students as they benefit from the different delivery methods from the classroom and the physical education setting. With the increased positive collaboration between teachers, physical educators can teach through means of activity, rather than a textbook, whiteboard, or the typical lecture. The purpose of this investigation is to offer ways to integrate other subjects into elementary physical education lessons that focus on body and spatial awareness, locomotor skills, and object manipulation skills. The lesson plans were created for first grade children (approximately ages 5 " 7 years). A total of 60 children from a public elementary school in rural area in the southern United States participated in the program. Each lesson plan incorporated the following components: a purpose statement, identification of the appropriate state education standards met by the lesson (i.e., identification of the skills achieved by the lesson), objectives for the psychomotor, affective, and cognitive domains, and integration of subject matter (e.g., math and body/spatial awareness). Examples of these lesson plans will be described in the presentation. Observations by instructors were made regarding student enjoyment, level of student participation, and ease of implementation/integration with classroom teachers. In addition, classroom teachers qualitatively evaluated the success of the lessons. The implementation of the lessons for groups of 20-25 students was successful. Students appeared to enjoy the lesson plans and associated activities. Increased engagement was observed for all students, including those that may not normally participate in traditional physical education lessons. Moreover, this integrative approach increased communication and cohesion among teachers and may facilitate student learning outcomes.

Drive to move and have fun! The preliminary results of applying modified ride-on toy car (ROC) training in toddlers with disabilities

Huang, Hsiang-han, Chen, Yi-Mei, Chang Gung University; Huang, Xuan-Wen, Chang Gung; Chen, Chia-Ling, Chang Gung University

The use of modified ROCs in the early mobility training program has been recently suggested as readily-available, low cost and fun options for toddlers with disabilities. The purpose of this pretest-posttest control group design

study is to investigate the effects of using ROCs in the hospital environment on improving mobility and socialization in toddlers with disabilities. A total of 20 toddlers with disabilities between 1 and 3 years were recruited from the hospitals in Northern Taiwan. The treatment group (10 participants, mean age: 21.0 months) received 9-week ROC training by an independent occupational therapist in the hospital environment (120 minutes/per session, 2 sessions/per week). The control group (10 participants, mean age: 23.7 months) received their regular therapy without any additional intervention. Chinese Version of Pediatric Evaluation of Disability Inventory (PEDI-C) and Parenting Stress Index (PSI) were administrated before and after the 9-week intervention. We used independent t-test and pair t-test to compare PEDI-C and PSI scores between and within groups. There was no significant difference between two groups regarding mobility, social function and parenting stress after the intervention. For within group comparison, the treatment group showed significant improvements on mobility (p=.01), social function (p=.03) and parenting stress (p=.01). The control group only had significant improvements on social function (p=.00). Moreover, the treatment group had more percentages of participants who have shown clinical, meaningful changes than the control group based on MCID of PEDI scores (treatment: mobility-50%, social function-40%; control: mobility-30%, social function-10%). This is the first study to demonstrate the feasibility of applying modified ROC training in the hospital environment to improve independent mobility and social skills in toddlers with disabilities. A future study with large sample size can be conducted to examine the components of this program, including the types of modified ROCs, the intensity and duration.

Single-subject design: Concerns establishing evidence-based practice in examining observational learning in ASD

Irwin, Jacqueline M., Pangelinan, Melissa M., Hinton, Vanessa, Lohse, Keith R., Rudisill, Mary E., Auburn University

The most challenging aspect of conducting quality research in special populations is obtaining an adequate sample size to reliably establish the efficacy of an intervention. Moreover, the heterogeneity of symptoms and behaviors exhibited by those with developmental disabilities such as autism spectrum disorder creates additional difficulties in using group design to establish evidence-based intervention practices. An alternative approach to the traditional group-based research design commonly employed in motor development research, is to use single-subject research designs, a type of experimental design commonly used in special education and clinical contexts. Horner and colleagues (2005) outlined the objective criteria needed to determine and document evidence-based practice or "experimental control" in single-subject research studies. With these criteria in mind, we conducted a systematic review of single-subject design research in observational learning of motor-based tasks in individuals with autism spectrum disorder to determine the efficacy of video modeling as an intervention in this population. Interestingly, despite the initial inclusion of 58 studies, upon closer inspection 26 were rejected for failing to meet the objective criteria outlined by Horner and colleagues. Of these 26 studies, two did not provided adequate visual data or description of quality indicators, 13 did not assess social validity of intervention(s) employed, and 19 did not establish experimental control or "functional relation" between the change in the dependent variable and the independent variable(s). Based on our review of these studies, we will discuss key methodological considerations when designing or evaluating single-subject studies. We will also discuss the methods for meaningfully combining the results from high-quality single-subject research studies using the results fro our systematic review as an example.

Developing new protocols to test fundamental movement skills; a necessity?

Issartel, Johann, Dublin City University; McGane, Bronagh B., Edge Hill University; O'Brien, Wesley W., University College Cork; Belton, Sarahjane S., Dublin City University

This study questions the validity of the current tools available to assess motor skill proficiency of adolescents. More specifically, this study examines whether fundamental movement skill proficiency can be measured with the currently available tools, that have been developed and validated over the years for the child population (e.g. MOT 4 - from Zimmer et al., 1987; Movement-ABC 2 from Henderson et al., 2007; KTK from Kiphard et al., 2007; TGMD-2 from Ulrich, 2000). At present, trainers, educators and researchers are facing a generation of adolescents that do not possess the basic requirement to engage and/or enjoy sports specific skills (O'Brien et al., 2015). Our current tools were not designed to capture FMS proficiency as children progress to adolescence, probably because in

previous generations this was not an issue with the older population. Does the research community have the necessary tools to measure adolescents FMS? As a result of these skills not being developed proficiently during childhood further investigation is required to discuss the appropriateness of extending the age bracket of current protocols, without any alteration of their content (i.e. test, protocol, measures, etc.). Responding positively to this point could lead to low levels of item discrimination indexes to differentiate participants' performance (e.g. items being either to easy or difficult). On the other end, responding negatively would impede the potential for longitudinal studies. This presentation will discuss the current state-of-the-art regarding protocols currently used by researchers measuring FMS proficiency of adolescents. The aim is to stimulate a discussion as to where the research community should go in the next 10 years to capture societal changes. Do current children develop new motor skills that older test cannot capture as they were not designed for this? If there is a need to develop new tests, what would be the role of both product vs. process oriented measurements? How can we go about capturing the maturation level across the child and adolescent spectrum?

Longitudinal examination of objectively-measured physical activity and sedentary time among children with and without motor coordination difficulties

King-Dowling, Sara, Kwan, Matthew Y.W., McDonald, Madeline, Cairney, John, McMaster University

Background: Research has found that children with Developmental Coordination Disorder (DCD) tend to be less active than typically- developing (TD) children. Much of the evidence, however, is based on cross-sectional and self-reported activity, and little is known about sedentary behaviours among children with motor coordination difficulties such as DCD. The current study examines the longitudinal patterns of objectively measured physical activity (PA) and sedentary time in children with and without possible DCD (pDCD). Methods: Data is from a 3-year longitudinal nested case-control study, with 103 participants (n=60 males, mean baseline age = 12.3±0.5 years) that were asked to wear an accelerometer for 7-days as part of the study protocol. Participants averaging <16th percentile on the Movement Assessment Battery for Children were considered to have movement impairments and pDCD (n=49). Mixed effects modelling was used to examine the effects of time, gender and pDCD on individual behaviour change. Results: Findings indicate significant main effects for time (Estimate=-23.98, $p<.01$) and gender (Estimate=59.86, $p<.05$) on total PA (TPA), and a main effect for time on sedentary behavior (Estimate = 15.58, $p<.05$). There were also significant main effects for pDCD (Estimate=-5.38, $p<.05$) and gender (Estimate=26.89, $p<.01$), and a time by gender interaction (Estimate = -7.50, $p<.05$) for moderate-to- vigorous PA (MVPA). No differences in sedentary time were observed between children with and without pDCD. Conclusions: These results indicate that males tend to engage in more TPA and MVPA compared to females. TPA decreased over time regardless of gender or pDCD status, but children with pDCD engaged in less MVPA compared to TD children. Consistent differences in MVPA over time, however, suggest that the divergence in MVPA occurs earlier in childhood. Further longitudinal research following a younger cohort is required to identify the specific point that differences in MVPA begin to emerge for children with and without motor coordination difficulties.—*Canadian Institutes of Health Research*

Postural control development in the first year of life

Kyvelidou, Anastasia, Wickstrom, Jordan F., Senderling, Benjamin, University of Nebraska at Omaha

Postural milestones in the first year of life are the most fundamental motor landmarks that an infant can achieve. Lying, sitting and standing, are not just passive postures, but active positions that enable the infant to develop subsequent skills, such as reaching, crawling and walking. Essential part of postural control is its inherent variability, which is necessary for fostering the adaptability and flexibility that an infant requires to develop new skills. Therefore, the purpose of this study was to monitor the development of postural milestones in the first year of life in typically developing infants and to examine the fluctuations of their inherent variability as learning to lay, sit and stand. We examined 11 typically developing infants at three, six, nine and 12 months of age. At three months we collected data from an FSA pressure mat while infants lay in supine position. At six months we collected data in supine posture as at three months, and during sitting on an AMTI force platform. At nine months we collected data during independent sitting and standing on an AMTI force platform. Lastly at 12 months we collected data during independent standing. From all the posture conditions, we examined the center of pressure (COP). We utilized both linear and nonlinear measures to analyze the COP trace. Linear measures included the root mean square and range in

the anterior/posterior (AP) and medial/lateral (ML) direction, as well as sway path. For the nonlinear measure we used sample entropy for both the AP and ML directions. The findings suggest that typically developing infants acquire differently each postural milestone, both in terms of amount (linear) and quality (nonlinear) of postural sway variability. In both lying and sitting, amount of variability seemed to decrease with experience, while quality of variability decreased for lying and increased for sitting with maturation and experience. Standing posture was completely different from lying and sitting.—*National Institute of Health*

Does participation in physical activity influence physical literacy among children with intellectual and development disabilities?

Lautenslager, Sara E., Federink, Amanda, McLeod, Kendra, Collins, Kyla, Bellerive, Andrea, Staples, Kerri, U of R

Participation in physical activity (PA) is primary component of physical literacy. Movement competence and levels of physical fitness are also key components. Children with intellectual and developmental disabilities (IDD) spend less time engaged in MVPA than their same- aged peers. They also have difficulty performing many of the movement skills essential for successful and meaningful participation in physicadl activity pursuits. Children with IDD also have lower levels of physical fitness. The aim of this study was to examine the relationship among components of physical literacy among children with IDD, ages 7 to 13 years. All children were participants in a 10-week PA program for children with IDD. Levels of physical activity were determined using Actigraph GT3X accelerometers and reflect the average intensity of participation in 2 or more sessions of the 90 minute PA program. The Test of Gross Motor Development - 3rd edition and the Brockport Physical Fitness Test to examine performance of fundamental movement skills and levels of physical fitness prior to beginning the 10-week program. On average, participants engaged in 15.49 minutes of MVPA at an average intensity of 3.56 METs. Pearson Product Moment Correlations were used to examine the relationship among components of physical literacy. Initial analyses do not support relationships among levels of PA and performance of movement skills or levels of physical fitness. This research will examine how participation in a structured PA program influences the relationship among these components.

Assessing measurement invariance of the Korean sport motivation scale (KSMS) for elite and non-elite athletes

Lee, Boram, Chung, Jihye, Sookmyung Women's University; Hwang, Seunghyun, Korea Institute of Sport Science

The Korean Sport Motivation Scale (KSMS) was developed to measure motivation for sport participation based on the factor structure of Self-Determination Theory (Deci & Ryan, 2000): 1) amotivation, 2) external regulation, 3) introjected regulation, 4) identified regulation, 5) integrated regulation, and 6) intrinsic regulation (Lee & Chung, 2015). The KSMS was designed to assess motivational state of multiple groups, such as sex and athletic level (i.e., elite vs non-elite athletes), which suggested examining if the KSMS is psychometrically equivalent across sex and athletic level. Thus, the purpose of this study was to test measurement invariance of KSMS across the groups. The data was collected from a total of 374 college students, which consisted of 199 athletes and 175 non-athletes. Also, 205 male college students participated in the survey while the number of females was 169. A series of measurement invariance modeling (i.e., Configural, Metric, Scalar, and Residual variance invariance) was conducted to see if the KSMS is an invariant measurement across sex and athletic level. In result, the KSMS factor structure was found to have an acceptable fit. The differences of the model fitness between the last two models for scalar and residual variance invariance were ""2=149.74, df=24, p<.001, "TLI=.012, "RMSEA=.004 for athletic level, while ""2=146.83, df=24, p<.01, "TLI=.013, "RMSEA=.004 were for sex, which concluded that factor loadings, intercepts, and residual variance were invariant across sex and athletic level. This study supports that the KSMS is a well-established assessment for motivation of sport participation across sex and athletic level, which validates that the mean of the motivational level from the multiple groups (i.e., sex and athletic level) can be compared.

How infants really learn to walk

Lee, Do Kyeong, New York University; Golenia, Laura, University of Groningen; Cole, Whitney G., Adolph, Karen E., New York University

We developed a new conceptual and methodological framework to examine the age-old question of how children learn to walk. Traditionally, research on the development of walking has focused on 'periodic gait' rather than 'natural walking'. In the standard gait test, infants are coerced to walk continuously as fast as possible in a straight line or to take steps on a motorized treadmill while researchers record standard gait measures. Typically, walking bouts in which infants stop, meander, or change direction are eliminated from analyses. We argue that theoretical progress has been stymied by reliance on the standard gait paradigm. Accordingly, we developed a new approach to assess infant walking proficiency in two conditions: in the traditional straight-path paradigm and during 20 minutes of spontaneous natural activity in a lab playroom. 41 Infants (walking age: .23 ~ 8.91 months) walked over an instrumented floor that recorded timing and placement of their steps. In addition, we used video to record their overall patterns of locomotion - shape of path and direction of steps. We find that the standard gait test fails to capture many of the essential features of early walking. In fact, in many important respects, natural walking does not resemble standard gait: Both novice and experienced infant walkers frequently produce bouts of upright locomotion with only 1-3 steps which are not periodic and too short to allow calculation of standard gait measures. Moreover, when infants do string together a series of continuous steps, they rarely walk in a straight line (only 22.32% of all bouts are straight) and most bouts contain omnidirectional steps (78.9% of all bouts). Like standard gait, natural gait shows improvements with walking experience (e.g., step length $r = .50$ $p < .01$) and standard and natural gait are well correlated, providing validation of both approaches (e.g., step length $r = .63$ $p < .01$). We suggest that a focus on natural walking, the phenomenon we ostensibly wish to explain, may lead to new theoretical insights into the development of walking.

Testing pathways of the Environmental Stress Hypothesis in children with and without Developmental Coordination Disorder

Li, Yao-Chuen, Kwan, Matthew Y. W., Graham, Jeffrey D., Cairney, John, McMaster University

Children with Developmental Coordination Disorder (DCD) are at an increased risk for being physically inactive, overweight, and experiencing internalizing problems, such as depression and anxiety (Cairney, et al., 2013; Missiuna, et al., 2014; Piek, et al., 2008). The Environmental Stress Hypothesis proposes several causal pathways connecting DCD, physical activity, BMI, and global self-worth to internalizing problems (Cairney et al., 2013); however more work is required to directly assess these pathways. The current study will examine some of these pathways, specifically examining the relationships between DCD, physical activity, BMI, global self-worth, and internalizing problems in school-aged children. Participants were 1206 children aged 12-14 years (79 with DCD, 6.6% of the sample). Children received assessments of motor coordination, physical activity, BMI, global self-worth, and internalizing problems. Path analysis was conducted in LISREL to examine the causal pathways that link DCD to internalizing problems with physical activity, BMI, and global self-worth as potential mediators. Results found that children with DCD were less physically active, had higher BMI, reported lower self-worth, and experienced a greater number of internalizing problems (p's $< .05$). There was a significant direct effect of DCD on internalizing problems ($b=2.33$, $\beta=.13$, $p<.001$). Consistent with the Environmental Stress Hypothesis, global self-worth mediated the relationship between DCD and internalizing problems, while physical activity and BMI mediated the DCD and global self-worth relationship. Overall, the findings support some specific pathways identified in the Environmental Stress Hypothesis. More work is necessary to test the complete model, but the results of the current study suggests that in addition to physical activity and weight control, interventions should target global self-worth as a way to mitigate potential mental health issues for children with motor coordination difficulties.

Comparison of three standardized motor assessment instruments on children with Autism Spectrum Disorder

Liu, Ting, Texas State University; Breslin, Casey, Temple University

To understand the motor movement and activity of children with autism spectrum disorder (ASD), tests and instruments are a necessity. It is important that the motor skills of children with ASD are assessed properly so they can be placed in appropriate educational settings that match their motor abilities. The purpose of this study was to compare three standardized motor assessment instruments, the Bruininks-Oseretsky Test of Motor Proficiency-2 (BOT-2; Bruininks & Bruininks, 2005), the Movement Assessment Battery for Children-2 (MABC-2; Henderson, Sugden & Barnett, 2007), and the Test of Gross Motor Development-2 (TGMD-2; Urlich, 2000)), on children with ASD and to provide recommendations for practitioners on how to choose the appropriate motor assessment instrument for this population. Twenty-one children with ASD (5-11 years; 18 boys and 3 girls) participated in the study and were assessed at a gym for all three motor assessments. It was found that majority of children scored in red (57%) and amber (21%) zone on MABC-2 indicating that they were at risk or had significant motor delays. Similarly to MABC-2, 64% of children scored in below average and 14% scored in the well below average category on BOT-2. Most children with ASD performed poorly on TGMD-2 (i.e., 7% below average, 36% in poor and 57% in very poor level). Furthermore, Pearson correlation analysis revealed that there was a moderate relationship between MABC-2 and BOT-2 (r=.63), a high correlation between MABC-2 and TGMD-2 (r=.73), and a low correlation between BOT-2 and TGMD-2 (r=.23). It is recommended that practitioners should have a basic understanding of the discrepancies in these instruments before making decisions on which motor assessment instrument to use for children with ASD. For example, the TGMD- 2 only assesses gross motor skills for children while MABC-2 and BOT-2 can be used to assess a wider range of fine and gross motor skills including stationary balance, locomotion, object manipulation, strength and agility, manual and body coordination, fine manual control, and manual dexterity.

Efficacy of Special Olympics Canada's active start and FUNdamentals programs at improving motor skills.

Lloyd, Meghann, Guest, Lindsay, University of Ontario Institute of Technology

Children with intellectual and developmental disabilities (IDD) have delayed and/or atypical motor skills that become more prominent with age. Poor motor skills can adversely impact various aspects of the lives of children with IDD including school, sport participation, vocational work, community and physical activity participation. Special Olympics Canada has developed 2 programs within the Long Term Athlete Development Model to target the development of fundamental motor skills of young children with IDD: Active Start (ages 2-6) and FUNdamentals (ages 7-12). The purpose of this study was to investigate whether children who participate in these 12 week programs in Ontario, British Columbia, Nova Scotia, and Saskatchewan improve their fundamental motor skills. Each participant was asked to demonstrate 4 skills from the Test of Gross Motor Development-2, including 2 locomotor skills (running and hopping) and 2 object control skills (overhand throwing and kicking); all skills were videotaped by trained instructors. The researchers scored the motor skills from the recordings for consistency. There were a total of 56 participants at study onset (n= 22 female), only 36 were retained at follow up (n= 13 female). As a group, there was a 58% increase in locomotor skill scores for Active Start Participants and a 62% change in score for object control skills. The FUNdamentals participants improved their locomotor skill scores by 37% and their object control skills by 26%. The preliminary results indicate young participants in Active Start and FUNdamentals programs run by Special Olympics demonstrate improvements in 4 fundamental motor skills. Data also indicate that, particularly for the younger participants, at the baseline testing the motor skills were significantly delayed for age; further justifying the need for early motor skill interventions for children with IDD. Future research should include larger samples and include all TGMD-2 motor skills; however, these results provide evidence that current programming is effective at improving motor skills in this population.

Motor competence in children and adolescents: Differences in health related fitness between high and low motor competence groups

Luz, Carlos, Instituto Politecnico de Lisboa; Almeida, Gabriela, Faculdade de Ciências da Saúde | Universidade Fernando Pessoa, Rodrigues, Luis Paulo., Escola Superior de Desporto e Lazer, Instituto Politécnico de Viana do Castelo; Cordovil, Rita, Faculdade Motricidade Humana, Universidade de Lisboa

The development of motor competence (MC) is essential in childhood. In this regard, previous studies have found several positive associations of MC with physical activity, cardiorespiratory fitness, physical fitness, and perceived physical competence, as well as an inverse association with body mass index. A low MC during this stage might, therefore, compromise the future adoption of active and healthier lifestyles. This study examined MC behaviour in 6 to 14-year-old children, and investigated the differences in health-related fitness (HRF) between high and low MC groups, according to gender and age. A random sample of 564 children (288 males) participated in this study, which was divided into three age groups (6-8 years; 9-11 years; 12-14 years). MC was assessed using a quantitative MC instrument divided into 3 categories (stability, locomotor and manipulative) with two motor tasks each (Luz, Rodrigues, Almeida, & Cordovil, 2015). HRF was assessed using a maximal multistage 20-m shuttle-run test of the Fitnessgram Test Battery (cardiovascular fitness), a handgrip test (upper body strength) and body mass index (body composition). MC increased across age groups for both genders, and although the intermediate age group (9-11 years old) presented more similarities between genders than the other age groups, boys presented better results than girls in MC and respective components (except on stability in the middle age group). Additionally, the manipulative component presented the higher gender difference across childhood and adolescence. The high MC group outperformed their low MC peers in HRF, independent of their age group. Although MC proficiency increased with age for both the high and low MC groups, low proficiency children do not seem capable to catch up with their peers within the study age range. The findings suggest that MC interventions should be considered an important strategy to enhance HRF, and girls should be a priority group from an early age.

The role of visual feedback and age when grasping and transferring objects in a virtual environment

Mason, Andrea H., University of Wisconsin - Madison; Grabowski, Patrick J., Rutherford, Drew N., University of Wisconsin - LaCrosse

The present study explored how crude visual feedback is used during prehension in a tabletop virtual environment. Nine children (M =9.5 years), ten middle-aged adults (M=43 years) and 7 older adults (M=72 years) performed three tasks. In the Reach to Grasp (RG) task, participants reached medially to grasp and lift a target within an interception zone (IZ). In the Transfer (Tran) task the participants transported the object with the left hand while reaching with the right hand to transfer the object within the IZ. In the Pass task, the object was transported by the experimenter while the participant reached with their right hand to grasp the object within the IZ. Crude visual feedback about the right index finger and thumb was provided in two conditions: vision available throughout the movement and vision available until movement onset. In a third condition, vision was absent throughout the movement. Participants performed between 5 and 10 trials (depending on fatigue) for each of the nine (3 tasks X 3 vision) conditions. Kinematic data for the participants' reach to grasp movements were collected using a VisualEyez (Phoenix Technologies) 3-D motion capture system. A Group X Task interaction was found for movement time (MT) ($F_{4,46}=2.7$, $p=0.04$). For children, MTs were shorter in the RG task (813 ms) than in the Pass (1009 ms) or Tran (948 ms) tasks. For middle adults, movement times were similar across all three task types (M=847 ms). For older adults, MTs were shorter in the Tran (810 ms) task than in the RG (916 ms) and Pass (939 ms) tasks. A main effect of Group for deceleration time indicated that DTs were longer for the middle-aged adults (59%) than for the children (54%) and older adults (55%). Reach to grasp performance was not influenced by visual feedback for any group or task. These results differ from our previous finding that young adults can use crude visual feedback, and may indicate that task performance is modulated by a reliance on pre-planning in children and older adults versus a reliance on proprioceptive feedback in middle-aged adults.—*National Science Foundation*

Evaluating the implementation of physical literacy programming in a recreation setting

McCallum, Kyle, University of Calgary; Sheehan, Dwayne, Van Wyk, Nadine, Mount Royal University; Katz, Larry, University of Calgary

Purpose: To assess the motor proficiency of kindergarten students (age 4/5) throughout the course of a physical literacy program structured for a recreation environment. Background: Literature over the last decade has shown negative correlations between body mass index (BMI) and fundamental movement skills (FMS). Various studies have attempted to incorporate physical education programs directed at increasing FMS of children and adolescents. Rationale: With physical literacy program implementation rising in the recreation and education sector, the need to assess the effectiveness of such programs is necessary to direct the future of programming. If programs are effective in the increasing of FMS of children, it can be assumed a positive correlation should be present between BMI and FMS. Research plan: A multi-staged random sampling intervention model will be utilized. Participants will be placed in one of three arms of the study, two acting as intervention groups, one as a control. The Test of Gross Motor Development, 3rd Edition (TGMD-3) will be utilized to assess the motor proficiency of children at three points throughout the program. The Bruininks-Oseretsky Test of Motor Proficiency, 2nd Edition (BOT-2) will be used to assess the balance component of children to allow for a complete evaluation of the children's motor proficiencies. Statistical analysis will help evaluate the effectiveness of the program, compared to general programming. Results: Data collection will conclude in April of 2015 to address the main purpose of the study, if a physical literacy program will increase the motor proficiency of children when compared to regular programming. Significance: The results can help evaluate the effectiveness of such programs, and help direct further program development and implementation in a recreation and education sector.—*Children's Hospital of Eastern Ontario*

The relationship between fundamental movement skills and perceived motor competency among an adolescent cohort

Mcgrane, Bronagh, Edge Hill University; Belton, SarahJane, Powell, Danielle, Issartel, Johann, Dublin City University

Introduction: Fundamental movement skills (FMS) and perceived motor competency (PMC) are seen as important contributors to future participation in sport and physical activity. FMS are considered the basic units of movement which allow for the development of more complex sport specific skills. The purpose of this study was to investigate the FMS proficiency levels and PMC levels of Irish adolescent youth. Methods: 395 adolescents, aged 12-13 years old, were tested. The Test of Gross Motor Development 2 was used to assess 6 locomotor skills and 6 object control object control skills. Three further skills including balance were assessed as they were deemed relevant to the Irish sporting culture. Perceived motor competency was assessed via questionnaire where children stated on a scale of 1 (not confident) to 10 (very confident) how confident they were at carrying out specific skills. Results: Overall participants performed below expected levels of FMS proficiency. Males performed significantly better than females in object control skills (p=.001) and in overall FMS proficiency (p=.001). There was a small positive correlation found between total FMS proficiency and total PMC (r=.219, p=.00). There was no significant correlation found between male total FMS and total PMC, however there was a significant positive correlation between female total FMS and total PMC (r=.305, p=.00). When further analysed there was a significant gender difference in performance of 10 FMS skills. However, a significant difference in PMC was found in all 15 skills with males scoring themselves higher than females score themselves in all 15 skills. This is highlighted by the viewing overall difference in means; for FMS proficiency males= 99.92, females=97.57 and for PMC males=124.54, females=112.79. Conclusion: Results from this study revealed that participants scored below the expected FMS proficiency threshold levels. This lack of proficiency among participants will consequently prevent them in the development of sport specific skills.

Specialization, injuries, menarcheal timing and the zone of peak height velocity (PHV): A retrospective recall of collegiate female swimmers

Monsma, Eva V., Barton, Nicole, Stodden, Dave F., Mensch, James M., University of South Carolina

Aligned with the Developmental Model of Sport Participation, we examined collegiate swimmers' (N = 66) retrospective account of injuries relative to the timing of PHV and specialization. Swimmers representing eight NCAA D1-D3 schools completed an online questionnaire. Swimmers were categorized as early (menarche < 11.8), average (11.9-13.8) and late (> 13.8) maturers. From the sample means of these groups, early (8.13-10.35 yrs), average (10.51-11.63) and late (12.48-15.66) zones of PHV were derived because PHV is documented to occur 1 year earlier than menarche (Zone: mean age at menarche+1SD " 1.0 year). Overall, ages at entry (6.96+2.96 years) coincided with the early zone, year-round (9.83+3.25) with the average zone, and ages at specialization (11.96+1.68) and dryland (12.81+2.62), with the late zone. Sampling sports and specialization later (>13 years: 65.5%) was more common than early specialization. Although under represented, early maturers specialized at a younger age (10.22+2.10) than average (12.63+3.21) and late (13.30+2.36) maturers. Injury prevalence was 40% (95% CI: 27.81% to 52.19%) with a trend for more chronic, upper body injuries among early specializers (p=.09). Of the 63 total injuries reported, first injury occurred at 16.87+ 2.68 years and 66.66% of injured swimmers reported continued lingering of injury. The likelihood of injuries did not vary across maturational timing, but was higher for single stroke (46.5%) than 3-stroke specializers (11.6%)*, and breaststroke specializers (93.3%)** compared to other strokes. Early specializers reported younger ages at year round* and dryland* but not ages at entry, or first injury compared to samplers. Zones of PHV can inform training decisions. Injuries tend to occur after PHV, regardless of specialization. Specializing early is unnecessary in swimming and may be a risk factor for lingering injuries during the collegiate years (*p<.05; **p<.01).

Developmental relationship between the recognition of gravity and the effect of projection speed on catching behavior

Mori, Shiro, Nakamoto, Hiroki, Ikudome, Sachi, Kisho, Ogasa, National Institute of Fitness and Sports in Kanoya

The present study performed two experiments to evaluate the developmental relationship between the recognition of gravity and the effect of projection speed on catching action in male university students, junior high school students, and elementary school children. In the first experiment, to identify the relationship between projection speed and catching action, an analysis was performed of the projection speed and the movement initiation time when catching a ball dropped randomly from positions depending on the projection speed (11.7 m/s;12.5 m/s;13.6 m/s). The movement initiation time was significantly lower among the junior high school students than among the elementary school children ($p < .05$). There were no significant differences in the movement initiation times among the three different projection speeds for each age stage. Additionally, up to approximately 0.6–0.8 s in the university students, 0.9–1.1 s in the junior high school students, and 1.1–1.4 s in the elementary school children after projection, no differences in the projection speed and catching action were observed across the projection speed range. This finding suggests that the projection speed is recognized at an earlier stage after projection as age increases. In the second experiment, to identify whether differences in awareness of gravity influence catching action, an analysis was performed of the relationship between coincident timing in response to a stimulus dropped at different gravity levels (1/2 G, 1 G, and 2 G) and the mean movement initiation time. There was a significant negative correlation at 2 G ($r = -0.691$, $p < .005$) among the junior high school students. On the other hand, there was a positive correlation at 1 G ($r = 0.521$) among the university students, but there was no significant. Thus, among male university students, the initiation of catching movement is adapted to objects falling at normal gravity than to projection speed; however, among junior high school students, the initiation of catching movement is influenced by stimulation after projection.

The impact of a Bupa 'Start to Move' intervention on children's Fundamental Movement Skills in the UK

Morley, David, Liverpool John Moores University; Till, Kevin, Ogilvie, Paul, Daly-Smith, Andrew, Leeds Beckett University

Objective: To assess the impact of a one day 'Start to Move' teacher-training intervention on the Fundamental Movement Skills of 4-7 year old children Design: A Pre and Post intervention Methods: 468 children (aged 4-7 years) participated in the study. All participants undertook the Bruininks-Oseretsky Test of Motor Proficiency,

Second Edition Brief Form (BOT-2) pre and post a 6 month period. Participants were split into an intervention (n=401) and control (n=67) group. The intervention group involved the participants primary school teacher attending the BUPA start to Move intervention (more info on the intervention). Control schools teachers received no intervention. A mixed model analysis of variance analysed the change in motor proficiency over the 6 months and between control and intervention groups. Findings: Significant improvements fine, gross and total motor proficiency occurred across the 6 month period for both control (Fine = 18.5±5.1 to 19.7±6.3, P<0.05; Gross = 8.2±3.6 to 9.3±4.3, P<0.05; Total = 26.6±7.7 to 29.1±9.1, p<0.01) and intervention (Fine = 18.7 " 5.7 to 20.5±6.2, P<0.001; 9.0 " 4.7 to 10.1 " 4.9, P<0.001; Total = 27.7 " 9.1 to 30.7 " 10.0, P<0.001) groups. However, standard score, controlling for age, significantly decreased in the control group (43.8 " 7.2 to 41.5 " 7.8, P<0.001) but did not change in the intervention group (44.6±7.9 to 44.5±11.6). However, no time x group interactions were found showing no differences in the change in motor proficiency between control and intervention group. Conclusions: When changes in BOT-2 were analysed by initial motor proficiency score (i.e., low, below average, above average, high) for the intervention group, analysis showed significant time x group effects with the participants with a lower starting motor proficiency demonstrating significantly greater improvements in motor proficiency across the 6 months (e.g., Standard score - Low = 34.3±4.4 to 39.0±9.9 vs High - 55.2±3.9 to 51.9±6.7).—*Youth Sport Trust, UK*

Relationship between posturography and the gross motor portion of the mullen scales of early learning in infants.

Motz, Zachary, Taubehnheim, Mariah, Wickstrom, Jordan, Senderling, Benjamin, Ambati, Pradeep, Kyvelidou, Anastasia, University of Nebraska at Omaha

The Mullen Scales of Early Learning (MSEL) is a standardized, valid, and reliable general developmental measure from birth to 68 months of age. MSEL can be used to assess cognitive and motor abilities. The scales have been utilized a great deal recently to evaluate gross motor behavior in infants at risk for autism. The MSEL is a subjective and non-quantitative evaluation of gross motor behavior. However, recent experimental paradigms may provide an objective method of evaluating gross motor function. Sitting postural control is a fundamental gross motor skill that can be examined in infants during sitting. Thus, the purpose of this study was to evaluate the relationship of the gross motor portion of the MSEL with an objective method, such as sitting posturography. Seven typically developing infants were evaluated at 6 months of age, when they could sit independently for at least 10sec. Center of pressure was collected for three trials of 10sec. Linear and nonlinear measures were used to evaluate sitting postural sway. Linear measures included: root mean square (RMS), range in the anterior/posterior (AP) and medial/lateral (ML) directions, as well the sway path. We also computed the sample entropy (SampEn) in both directions. For statistical analysis we computed simple linear correlations with each of the postural variables and the MSEL motor T scores. The findings showed that only RMS (r=-0.749) and Range (r=-0.866) in the ML direction had a strong negative correlation with the MSEL motor scores. However, SampEn in the ML direction had a moderate positive correlation with the MSEL motor scores. Infants that had greater MSEL motor scores have lower Range and RMS values in ML direction and infants that had lower MSEL motor scores had greater Range and RMS values in ML direction. In contrast, infants that had greater MSEL scores had greater SampEn values in the ML direction, whereas infants that had lower MSEL scores had lower SampEn values in the ML direction. It is evident that the MSEL motor score seems to capture better ML posture behavior than AP.

A preliminary study of motor development in South Korean children aged 4-6

Nam, Soo Mi, Seoul National University; Kim, Min Joo, Kyung Hee University; Song, Young Hoon, Yang, Jin Joo, Kim, Seon Jin, Seoul National University

Movement Assessment Battery for Children-2(MABC-2) is one of the general motor development assessment tools used in research, physical education and clinical filed. MBC-2 could provide detailed information related levels of overall motor development in children. Also, it is used to detect movement difficulties in children. As professionals in other countries use the MABC-2, validation for MABC-2 is required to consider the influence of the cultural and society context and race on the development of children from different countries. The purpose of the present study was to investigate general tendencies of motor development in South Korean children aged 4-6 for modify MABC-2 in South Korea. 73 preschool children (57 boys and 16 girls) aged 4-6 years old (M=65mon., SD=9mon.) were participated. One professor who has expertise MABC-2 three professionals who has teaching experience children at

least 3 years evaluated their motor development using the MABC-2. We run descriptive statistics to find trend and characteristic of the result. The data represented by percentile was presented separately regarding gender, as well as age. 10 children were shown poor motor performance below 16% of MABC-2. They can be categorized developmental coordination disorder (DCD) spectrum. There is differences depending on gender and age. The boys with DCD had lower percentile in balance tasks(M=32.00, SD=15.98) compared to the girls (M=61.67, SD=9.19). The girls with DCD showed low percentile in manual dexterity (M=9.00, SD=9.90) and aiming and catching (M=1.17, SD=0.71) domain. In addition, the percentile of aiming and catching tasks in children with DCD had a tendency increased with age (Age=4y.: M=9.25, SD=11.09, Age=5y.: M=15.88, SD=18.14, Age=6y.: M=20.50, SD=6.36). As literature has shown, we might state 5-6% of Korean children aged 4-6y. seems to have DCD. Also there seems gender difference and improvement regarding to age. The present study will be utilized for further study regarding the standardization of the MABC-2 in South Korea.

Age differences in movement coordination are dependent on task difficulty

Padmanabhan, Malavika R., Lee, Mei-Hua, Michigan State University

One of the fundamental questions in motor learning is whether or not children and adults learn differently, especially when learning a novel motor task. In a previous study, we found age-differences in movement coordination, specifically, children had difficulty in performing a 2-D cursor control task, because of an inability to distribute their motor variability over multiple dimensions. In this study we further investigated if these age-differences in movement coordination would interact with task difficulty. Participants' upper body movements were measured using 4 inertial measurement units (IMU) and mapped to the position of a screen cursor. The body space was an eight dimensional space (2 signals per IMU) and the task space was a 1-D space (instead of the 2-D space used in the earlier study). Participants learned to control the cursor to reaching targets that were placed along a single row. Both children and adults practiced for a total of 160 trials reaching toward 4 targets. To examine the generalization, we also included three generalization tests during learning (pre, during and post-practice), where participants reached toward 4 additional targets. Principal Component Analysis (PCA) was used to perform the dimensionality reduction. Results showed that task difficulty did influence the age differences observed. While 9-year-olds had longer movement times compared to adults even in the 1D task (similar to the 2D task), the 12-year-olds were not significantly different from adults. These results suggest that the development of coordination and control have different time courses - while both 9-year and 12-year-olds) have difficulty in coordination (i.e. channeling variability across multiple dimensions), 9-year olds have difficulty even in controlling variability along a single dimension. These results have implications for structuring practice schedules in children, including pediatric rehabilitation.

Agreement between expert and novice coders' scores on the Test of Gross Motor Development-2nd Edition

Palmer, Kara K., University of Michigan; Brian, Ali, University of South Carolina; Rui, Ma, Shanghai Normal University

Background. The Test of Gross Motor Development-2nd Edition (TGMD-2) is one of the most widely used measures of motor skill competence in children (Ulrich, 2000). The TGMD-2 is often used in both research and educational settings. Currently, educators and practitioners using the TGMD-2 do not undergo specific training on how to score the assessment, and no information exists in regards to the implications of training on TGMD-2 scores. The purpose of this study was to examine if differences in scores exist between expert and novice coders on the TGMD-2. Methods. Three coders, one expert and two novices, scored young children's (N=43; Girls=43%; Mage=4.88, SD=.28) TGMD-2 data. The expert coder had over three years of experience coding TGMD-2 data whereas the novice coders had never previously scored the assessment. Both the novice and expert coder underwent a similar training protocol and also established inter-rater reliability with an outside researcher. The kappa statistic was used to determine agreement between expert and novice coders on the locomotor and object control subscale of the TGMD-2. Independent samples t-tests and percent differences were used to determine scoring differences between coder groups for each of the twelve skills. Results. Results support that expert and novice coders do not demonstrate significant agreement when scoring both the locomotor (k= -.001, p=.96) and object control subscales (k= -.004, p=.86) of the TGMD-2. Post hoc comparisons show that expert and novice coders only scored the kick (t41= -1.3, p= .2) and the gallop (t41= -1.7, p=.09) similarly. Conclusion. The data support that expert and novice

coders do not score the TGMD-2 equivalently. This difference could have large-scale implications in the educational and intervention realms. More stringent and/or consistent training regiments are needed prior to allowing individuals to TGMD-2 data.

Cognitive function state underlying patterns of movement coordination during behaviors by the elderly: applied to a system approach

Park, Chulwook, Seoul National University

This study investigated older adults' behavior that correlates with the causal cognitive features involved in the executive control of an inhibition function during goal-oriented circumstances. To evaluate motor coordination, spatial-based bi-manual coordination coupling and temporal-based eye-hand coordination responses were used. To assess executive function, Stroop Color-Word Test was used, which is considered as an ideal tool for studying typical and atypical executive processing (inhibition of dominant or prepotent responses). The present study observed the association between decreased asymmetric bi-manual coordination and poor performance in a test of Stroop error effect. Given the main evidence of executive function as a core cognitive ability, the strong association between discrete-bimanual stability observed here, and the Stroop error effect suggests that asymmetric coordination performance may be a useful index of early cognitive decline. The results showed that although the general interference of a Stroop test as expressed in the executive function is closely related to coordinative ability in the elderly, this cognitive ability associated with a behavioral state has limitations when seeking a perfect understanding of this without detecting the causal importance of the Stroop error effects. This consideration may expand not only our understanding of the executive function state underlying normal or abnormal patterns of movement execution and inhibition during behaviors by the elderly, but it also may explain the interconnected transitions between one and two modes that occur as the size of the symptom to be grasped varies. This is a feasible hypothesis which demonstrates a proof of concept in how interconnected interactions between state and parameter dynamics can be modeled and how each of the linear variable states (cognition, and behavior) can be mutually interactive.—*This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2010-0021103).*

A Case for Reconsidering the Cut-off Scores for the revised Developmental Coordination Disorder Questionnaire (DCDQ'07)

Patel, Priya P., Gabbard, Carl, Texas A&M University

Introduction: The revised Developmental Coordination Disorder Questionnaire (DCDQ'07) is widely used for 'screening' of children at-risk for DCD. It has been widely accepted and adapted for use in several countries. With those adaptations, there has been speculation that cut-off scores recommended in the DCDQ'07 manual need to be modified in order to improve its sensitivity (e.g., Caravale et al., 2015). Therefore, the aim of this study was to investigate sensitivity of DCDQ'07 manual cut-off scores when the instrument is being adapted to Hindi language for use with Indian children. Method: Data from a recent DCDQ'07 Hindi language adaptation (parents of 955 children, ages 5-15 years) was used for this study. This Indian adaptation (DCDQ-I) was found to be reliable and equivalent to DCDQ'07 (Patel et al., 2016). Total data set was divided into 3 age groups, namely: Group 1 (5 - 7 years), Group 2 (8 - 9 years) and Group 3 (10 - 15 years). Two cut-off scores were used to identify children at risk for DCD; DCDQ'07 manual cutoff scores identified as 'probable DCD' and for purpose of this study, more stringent scores (≤ 36) labeled as 'more probable'. Results: Percentage of children at risk for DCD, using DCDQ'07 manual cut off scores ranged from 22 - 58% across 3 age groups (average 51%). Using more stringent cutoffs, it ranged from 5 - 9% (average 7%). Chi-square analysis showed a significant difference between probable and more probable DCD counts ($p < .05$). Discussion: Probable prevalence rate (average 7%) of children at risk for DCD as predicted by the stringent cut-off scores are more in line with predicted estimates for populations in larger nations like the United States. However, these results need further validation by confirming the diagnosis using standard testing tools like Movement Assessment Battery for Children - 2. In conclusion, based on our data and remarks by other researchers on adaptations of the DCDQ'07, it can be suggested that original cut-off scores be re-examined to determine sensitivity in initial identification of children at risk for DCD.

Motor development of infants living in prison environment: Comparisons with Brazilian and Canadian normative data

Pereira, Keila R G., Valentini, Nadia C., UFRGS; Saccani, Raquel, Universidade de Caxias do Sul

Introduction: The number of imprisoned women is increasing at considerable pace worldwide, including Brazil. A large number of these women are pregnant and Brazilian law guarantees them to stay with their children, therefore it is inferred that the number of children placed in the prison environment also increased in recent years. Investigate the conditions and opportunities as well as the children well being in this hostile environment is essential in order to provide appropriate care. At the present study, we report only the results on motor development of the infant inserted in Brazilian prisons and compared infants' performance with normative data of Brazil and Canada. Methods: 270 infants aged from zero to 17 months from 27 prisons of Brazil were evaluated using Alberta Infant Motor Scale (AIMS). To compare raw scores between populations of infants from prison with normative data sets, the one sample t-test was used. The level of significance was established at 5%. In comparison with Brazilian normative data, infants living in prison presented lower motor scores in first month and higher scores in fifth and sixth months. In comparison with Canadian data, differences were observed in first, second and fourth months, with Canadian infants showing higher motor scores. Conclusion: Infants living in Brazilian prisons presented motor performance similar to normative data of Brazil and Canada, with some differences during first semester of life, suggesting that stay with mother and the experience of individualized care environment are protective factors for development, even when this occurs in an environment with few opportunities for development.

Physical activity in toddlers: How many days and hours of accelerometer measurement do we need?

Pitchford, E. Andrew, University of Michigan; Hauck, Janet L., Michigan State University; Ulrich, Dale A., University of Michigan

Objective: The purpose of this study was to establish the minimum number of days and hours of accelerometry needed to measure physical activity in toddlers. While recommendations for physical activity monitoring procedures exist for preschool and older children, little is known for the use of accelerometers in toddler age children. Methods: A total of 36 toddlers (19 M, 17 F), average age of 18.26 (SD = 3.92) months, wore an Actigraph GT3X-BT triaxial accelerometer for seven days. Generalizability (G) theory using variance component analyses were conducted with a one-facet fully-crossed design on the average vector magnitude counts per day and hour, respectively. Average daily time spent engaged in physical activity was calculated using validated cut- points for toddlers (Trost et al., 2011). Results: The G-theory reliability coefficients for the Hours facet were high (G = .834, Phi = .842). Variance components included Participants (26%), Hours (5%), and the interaction plus any unexplained error (69%). Both coefficients exceeded 0.80 with 11 or more hours of monitoring (G = .800, Phi = .805), indicating the minimal monitoring period. The Days facet also had high reliability coefficients (G = .881, Phi = .887) with variance components for Participants (55%), Days (3%), and the interaction plus unexplained error (42%). Measurement on 3 or more days was determined to be reliable (G & Phi = .831). Toddlers in the sample engaged in an average of 136.19 (SD = 32.45) minutes of light physical activity and 56.39 (SD = 16.59) minutes of moderate physical activity per day. Conclusion: These results indicate that physical activity counts in toddlers can be highly variable across days and hours. However, monitoring periods of at least 3 days and 11 hours can provide generalizable estimates of physical activity behavior in toddlers. Fewer days of monitoring should ease the burden on parents to complete and adhere to research protocols. These findings are critical for measuring physical activity in younger populations as part of the growing impetus for early intervention.

Clinical validity of the test of gross motor development - 3rd edition for children with identified disabilities

Pitchford, E. Andrew, University of Michigan; Webster, E. Kipling, Louisiana State University; Ulrich, Dale A., University of Michigan

Objective: The Test of Gross Motor Development (TGMD) is a norm- and criterion-referenced measure of gross motor ability for children ages three through ten years. It is one of the most popular assessments in pediatric motor research and is commonly used for determining eligibility for Adapted Physical Education services. The present

study aimed to assess the clinical sensitivity of the TGMD 3rd edition to justify its utility in schools. Methods: A total of 48 participants with an identified disability completed the TGMD-3 assessment, including 26 with autism spectrum disorders (ASD), and 22 with an intellectual/developmental disability (IDD). Samples of typically developing children were matched on gender, age, and race/ethnicity (n = 26 and 22, respectively), and were used to assess if the TGMD-3 can discriminate between samples with and without disabilities. Results: Mann-Whitney (U) group comparisons showed a variety of group differences compared to matched typically developing peers. Youth with IDD had significantly lower locomotor and ball skills ($p<.05$). Youth with ASD had significantly lower ball skills ($p<.05$) but not locomotor skills ($p>.06$). Area under the receiver operating curves (AUROC) for locomotor and ball skill subtests were acceptable for IDD (.78, .85) and ASD (.65, .79), respectively. Specific skills that were less discriminating in the ASD sample (AUROC < .60) included the run (.59), gallop (.52) and slide (.49). Conclusion: This study indicates that the TGMD-3 is effective in discriminating between children with disabilities and typically developing peers. The assessment is functional in identifying differences in both subtest for IDD and ball skills for ASD. Less favorable discrimination was observed for locomotor skills in ASD. The lack of consistent differences for the ASD sample is consistent with current literature as motor deficits can be highly variable. In conjunction with existing validation of the TGMD-3, these findings justify the use of this assessment of motor ability and its continued use in research and school settings.

The 2D:4D ratio, hand dominance, and gender

Protopapas, Helen A.M., Bryden, Pamela J., Wilfrid Laurier University

The ratio of the difference between the second and fourth digits of the hand (2D:4D) has been illustrated to be an indirect indicator of prenatal testosterone levels. Prenatal testosterone has also been found to play a role on the development of the brain in utero, and thus may influence body asymmetries, such as handedness. Therefore, the current study was to examine whether the 2D:4D ratio can be predicted by the handedness and sex of an individual. The right and left 2D:4D ratios were compared, and the difference between the right and left digit ratios were analyzed. Participants completed two tests to measure their handedness. The Waterloo Handedness Questionnaire was used as an indicator of hand preference, while the Tapley-Bryden Dot Marking Task tested hand performance. Right and left 2D:4D ratios were measured for all participants (N = 30, average age = 24.3 years, females = 18) using vernier calipers, measured to the nearest 0.01mm. Results indicated a main effect of sex on the difference between the right and left digit ratios ($F(1, 26) = 5.03$ $p = 0.034$). Females had a smaller difference between their right 2D:4D ratio in comparison to their left 2D:4D ratio than did males. Handedness also affected the difference in digit ratios between the hands ($F(1, 26) = 5.96$, $p = 0.022$), such that both right-handed and left-handed participants had a lower 2D:4D ratio on their preferred hand than they did for their non-preferred hand (mean difference = -0.02mm for both groups). Overall, seeing a greater difference between the digit ratios in males indicates that increased prenatal testosterone levels are acting on brain lateralization in comparison to females. In addition, given that the lower of the two digit ratios predicted hand preference, this is suggestive that prenatal testosterone may have an effect on brain lateralization, more specifically potentially influencing the hemisphere that controls the dominant hand. Data is currently being collected to examine these variables in a group of typically developing children, and a group with autism spectrum disorder

Postural change with advancing age as a function of task difficulty.

Rath, Ruth C., Wade, Michael G., University of Minnesota

Earlier research from our Affordance Perception-Action Laboratory (APAL; School of Kinesiology, University of MN) indicates that postural support while engaged in either perceptual or cognitive tasks shows a change in the "embodied" relationship between postural motion and task engagement. As we age, the stability of postural control is impacted while engaging in supra-postural tasks. In typically developing populations postural motion is modulated (reduced) as a function of task difficulty. Earlier APAL research shows that this is not the case for children with movement difficulties (Chen et al., 2011) or for individuals with early onset dementia (Jordan et al., 2015). The relationship is less well documented in older adults as they progress into their 6th, 7th, and 8th decades of life. The present study recorded postural motion in a sample of individuals ranging in age from 60 to 80+ years. The protocol recorded postural motion as center of pressure (CoP) while a participant was engaged in two levels of a digit-recall task. A digit memory test (either high or low difficulty) determined for each individual the maximum

number of digits correctly retained for 10 seconds; the low difficulty condition comprised 50% of the total digits presented during the high difficulty condition. Participants recorded three trials in each of the two conditions, for a total of six trials each. Trials were blocked such that half of the participants performed the low difficulty condition first and the high difficulty second; the other half performed the two tasks in the reverse order. Participants were assigned to one of three age groups: 60-70yrs, 71-80yrs, and 80+ yrs. The data were analyzed in a 2x3x6 (task x group x trials) ANOVA. The results are discussed with reference to changes in the level of postural support evidenced as a function of task difficulty, within the context of advancing age. Postural control is an important element of the complicated issue of falls in older adults; this project will help to clarify our understanding of this prevalent concern.

Retention of executive function in assisted cycling therapy in adolescents with Down syndrome
Ringenbach, Shannon D., Holzapfel, Simon, Richter, Madeline, Arizona State University

We have shown promising results of Assisted Cycling Therapy (ACT) for improving executive functioning in adolescents with Down syndrome (DS). The current study examines the one month retention of executive function benefits gained by adolescents with DS. Sixteen participants were randomly divided between voluntary cycling (VC) (i.e., self-selected cadence) and ACT (i.e., 35% faster than self-selected cadence accomplished by a motor) groups. Both cycling groups rode a stationary bicycle, for 30 minutes, three times a week, for eight weeks. At the beginning (i.e., pretest) and end (posttest) of the 8-week session, and at a one month retention, three executive functions including: set-switching, inhibition, and cognitive planning, were measured. The results showed that for the ACT group cognitive planning improved after 8 weeks of ACT and these improvements were maintained after one month of no cycling. However, no significant differences were found between the cycling groups for our measure of inhibition. Set-switching appeared to be improved by both types of exercise, rather than only ACT, but the improvements were not maintained during the one month retention period for either group. Thus, our results suggest that, especially for cognitive planning, ACT may lead to relatively permanent changes in the brain.

Children with and without developmental coordination disorder (DCD) have greater local dynamic stability compared to adults during bimanual finger tapping
Roche, Renuka, Eastern Michigan University; McAndrew Young, Patricia M., Whitall, Jill, University of Maryland at Baltimore

Variability is a hallmark of motor performance in children with developmental coordination disorder (DCD). In this study of bimanual tapping, we used both linear tools to assess the amount of tap variability and a non-linear analysis to assess the local dynamic stability [or local divergence] of individuals' finger movement trajectories. Participants included children with DCD (n = 24; mean age + SD 9.29±1.75 years), 22 age- and gender-matched typically developing (TD) children (mean age in years 9.22±1.79) and 18 adults (mean age + SD 24.46±2.75 years). Participants synchronized bimanual antiphase finger tapping to an auditory cue set at 1.4Hz in 2 trials of 25 s. Kinematic data were acquired using Ascencion miniBIRD" magnetic tracking system with a sampling frequency of 100Hz. Children with and without DCD had increased local dynamic stability (i.e. lower Lyapunov Exponent values) than adults ($p < 0.001$). However, children with DCD had greater coefficient of variation of the intertap interval compared to TD children ($p < 0.001$) and adults ($p < 0.001$) and TD children were more variable than the adults ($p < 0.001$""). Adults ($p = 0.016$) and TD children ($p = 0.042$) but not children with DCD had higher coefficient of variation of the kinematic data in their non-dominant finger than their dominant finger. Overall, these results suggest that the variability of children with DCD is limited to the temporal goal (coincident tap) of the task and not to the whole trajectory of the movement where they use a similar control strategy as TD children, i.e. freezing degrees of freedom to accomplish the goal.*—NIH (Grant RO1 HD 42527 (PI: JE Clark; subcontract PI: J Whitall)) and UMB Graduate school (Graduate School Assistantship to Renuka Roche)*

Drop landing in children

Romack, Jennifer L., Rosales, Marcelo R., Angulo-Barroso, Rosa M., California State University, Northridge

Studies examining how young children control landing from a height (drop land) and how their strategies change over time are scarce. On the other hand, studies focusing on drop landing strategies of post-pubescents and adults are abundant, with consistent results showing less knee and hip flexion upon ground impact. These studies typically use a standard height (horizontal bar or box) that participants drop from and land. The purpose of our study was to address the gap in the literature regarding the development of landing strategies among children by adjusting drop height relative to each child's height and vertical jumping ability. Seventeen children (5.01 years +/- 1.34) participated in this study. Each participant was asked to hang passively from a horizontal bar placed at a calculated height (40% leg length + 40% maximum vertical jump height (MVJ) + maximum reach height (MRH)) and then was asked to let go (drop) and land on two force Kistler force plates. Kinematics (Qualisys) of five drop landing trials were assessed, including whether or not the child was able to control the land by not stepping or falling. Results suggested that maximum hip flexion during the landing phase was negatively correlated with age ($r = -0.36$, $p = 0.08$). In addition, the maximum knee flexion during landing was weakly correlated with age ($r = -0.25$). Strategies to stabilize the drop landing improved with age. Older children demonstrated less stepping or falls after impact. As expected MRH and MVJ were significantly and positively correlated with age ($r = 0.90$; $r = 0.86$, respectively). When adjusting for drop height considering the child's height and vertical jump ability, two aspects of the drop landing changed with age: (1) strategies to stabilize the drop became less dependent on stepping, and (2) maximum hip and knee flexion during landing became smaller as children became older. Future research should examine the kinetic and muscle activation characteristics that drive these particular changes.

Do young obese women exhibit balance disadvantages?

Roncesvalles, Maria N., HESS, Texas Tech University; Dubey, Neha, Texas Tech University

Does obesity negatively impact balance in young women" Critical sensory systems were tested (vision, vestibular, somatosensation), comparing obese (OB, N=19), and non- obese (NOB, N=45) young women (19-21 years, Texas Tech University). Mean BMI for NOB and OB were 22 and 32.4 kg/m2 respectively. Mean fat % were 25.3 (NOB) and 42.1 (OB). The sensory organization test (SOT) protocol (Balance Master") assessed stance in six conditions (18 trials, 20 s): easy (C1), moderate (one non-functional sensory organ, C2, C3, C4), and difficult conditions (C5, C6, two non-functional systems). Through "no-vision" (C2), or 'sway-referencing" (C3, C4), imbalance results. When self-sway corresponded ("referenced") with A-P motion of surrounding panel (C3) or platform (C4), sway detection is hampered by dissonant cues. Balance is recovered thru remaining functional systems (e.g. vestibular). Overall equilibrium (EQ) and condition scores were compared. To control for discrepant sample sizes, SPSS randomly selected 19 NOB women matching the OB group. Significant differences in EQ resulted: $t (36) = 3.185$, $p=0.003$; $d=1.06$: NOB scored higher, therefore better (M=84.63, SD=3.76) than OB (M=80.37, SD=4.46). The easy (C1) and difficult (C5, C6) conditions yielded NS differences. Moderate conditions (sequence: C2, C3, C4) rendered mixed results: but NOB advantages in C2 and C4 seem to drive overall EQ. With no vision (C2), or impaired somatosensation (C4), NOB recovered balance better: switching reliance to the vestibular and remaining functional organs (somatosensation, C2; vision, C4). Significant advantage for OB in C3 (sway-referenced vision) resulted; upon closer examination OB did not get better from C2 (M=91.8) to C3 (M= 91.4). Instead, performance drop by NOB from C2 (M=93.6) to C3 (M=84.9) was noteworthy. Perhaps NOB healthy subjects were more sensitive to tricked-up vision. Overall, lower balance scores of young OB women is worrisome. Specific investigation is needed on how balance disadvantages impact functional performance.

Measuring perceptions of competence in young children: The influence of performing and observing one's performance on perceived competence scores

Rudisill, Mary E., Wadsworth, Danielle D., Irwin, Jacqueline M., Hastie, Peter A., Johnson, Jerraco L., Bridges, Claire E., Auburn University

Perceptions of physical competence are related to a child's motivation to engage in physical games, sports, dance and other related movement activities (Harter, 1981; Stodden et al., 2008). Currently, there is no evidence to determine how practicing a skill or observing oneself practicing the skill affects perceptions of physical competence.

The purpose of this study was to determine if young children's ability to perceive their own actual motor skill competence is influenced by performing the motor skills and/or observing their own actual motor skill performance. Children (n = 106) from grades K-2 were asked to completed the Harter & Pike Pictorial Scale of Perceived Competence and Acceptance three times (only running, dribble, hop, and skip items). Times were (a) baseline, (b) after completing each skill, and (c) after observing themselves completing the skill on video. The results indicated that perceived competence for running differed by condition ($p = .021$). Specifically, perceived competence significantly decreased after the children performed a running task ($p = .048$) and after they observed their running when shown on a video ($p = .003$). There were no differences in perceived competence for skipping, hopping and dribbling ($p > .05$). These findings suggest that children's perceptions of physical competence may be influenced by observing their own performance. Researchers and practitioners should be aware of these findings when assessing perceptions of competence.

Assessing perceptions of competence: Does performing motor skills and observing motor skill performance influence a child's accuracy of their perceptions

Rudisill, Mary E., Wadsworth, Danielle D., Irwin, Jacqueline M., Hastie, Peter A., Bridges, Claire E., Johnson, Jerraco L., Auburn University

Research has shown that perceptions of competence are related to achievement motivation and that young children are not accurate in their perceptions of physical competence (Goodway & Rudisill, 1997; Nicholls, 1978; Rudisill, Mahar, & Meaney, 1993). The purpose of this study was to determine if children are more accurate in perceiving their own motor skill competence if given an opportunity to perform and observe a video of their own motor skill performance. Participants were asked to complete the Harter & Pike Pictorial Scale of Perceived Competence and Acceptance (only running, dribble, hop, and skip items) before and after they were videotaped performing the same motor skills and once more after observing the video performance (run, skip, dribble, and hop). The Test of Gross Motor Development-3 (Ulrich, 2015) testing protocol and criteria were used when assessing and coding the motor skills. Each child was then given an opportunity to observe his/her motor skill performance from the performance video, and asked to complete the perceived competence scale for a third time. A total of 76 kindergarten (n = 28) 1st grade (n = 20) and 2nd grade (n = 27) children completed the study. The results showed that perceived competence was significantly decreased after viewing a video of themselves running, but not while hopping, dribbling, or skipping ($p = .016$). A simple linear regression indicated that all perceived competence scores following video viewing were better predictors of actual motor competence ($p = .014$). The results indicated that perceptions of competence may be influenced by observing performance.

Product oriented throwing, kicking and jumping motor performance data across childhood

Sacko, Ryan S., Pfeifer, Craig, Nesbitt, Danielle, Stodden, David F., University of South Carolina

Objectives: As interest on children’s motor development and its impact on various aspects of health increases (Robinson et al., 2015), there is a renewed interest in understanding how motor performance (i.e., product- oriented motor competence) changes across childhood. However, limited data exists on children’s product-oriented fundamental motor skill performance throughout the past decade. Purpose: To examine children’s throwing, kicking and standing long jump performance across ages 4-11 years. Methods: Data on 915 children (boys n=445, girls n=470), ages 4-11 years, were collected from 2007-2015 from the Midwest, Southwest and Southeast regions of the United States. Maximum kicking and throwing speeds (m/s) were collected using a radar gun (Stalker Inc.) and maximum jump distance as a percentage of body height (cm) was assessed. Descriptive data on the performance of all three skills by sex and by year were calculated. Sex differences across age were examined using t-tests. Results: Boys and girls increased performance in both kicking and throwing skills across childhood. Jumping performance plateaued at seven years, and remained stable through age 11. Six year old data was removed from consideration due to a low sample size. T-tests revealed significant sex differences in performance of all skills across all ages. Sex differences in throwing speed increased over time supporting previous trends (Thomas & French, 1985). Although kicking also demonstrated sex differences at each age, differences in performance between boys and girls did not increase across age. Conclusion: These data provides an initial snapshot of fundamental motor skill performance data in 4-11 year-old US children. Similar to previous research, sex differences remain in this diverse sample of children. Establishing normative data on product-oriented motor skill performance in children is an important

endeavor as emerging data demonstrates the development of motor competence is consistently related to multiple health-related variables across childhood.

Effect of perturbations on gait when infants learned to cruise

Sansom, Jennifer K., Dornbos, Kara, Recla, Margo, Roberts, Kelsey, Central Michigan University

For infants, developmental changes and experiences significantly influence the stability of motor skill performance. Typically, older infants have more experience and show lower variability than infants who are younger. However, little is known about how infants respond to perturbations when learning a new developmental skill. The purpose of this study: examine how the stability of a developing system was affected by the introduction of 2 perturbations as infants learned to cruise. We tested infants monthly from onset of forward cruising (i.e., walk w/support) until walk onset in 3 conditions: 1) cruising in diaper only (C), 2) cruising in a lycra garment (LG), and 3) cruising w/2nd diaper (DD). We placed 20 retro-reflective markers on anatomical landmarks and 8 electromyography electrodes bilaterally on leg muscles. Infants cruised forward, holding onto a custom-designed pushcart. We examined classic gait characteristics and associated variability. Our results showed that infants took fewer strides that were shorter and slower while spending more of the gait cycle in stance, and concurrently in double limb support, when wearing DD compared to C or LG. However, infants took steps that were more consistent in step width when wearing LG and DD while cruising at walk onset, but all other variables showed increased variability when wearing DD. Our infants showed small, but unique adaptations to the acute influence of garments w/different properties relative to level of cruising experience. By independent walk onset, when infants were actively transitioning between cruising and independent walking, they showed the ability to adapt to some of the affordances provided by the imposed perturbations. Step width was the only gait variable that both LG and DD resulted in decreased variability while cruising at walk onset. This finding may indicate that the postural adjustments made by infants to wear of LG and DD that resulted in infants increasing their step width also facilitated a sense of increased stability during cruising compared to C.

Anticipatory planning in joint action object manipulation: An examination of children, young and older adults

Scharoun, Sara M., University of Waterloo; Bryden, Pamela J., Wilfrid Laurier University; Roy, Eric A., University of Waterloo

The manner in which objects are grasped and subsequently passed in joint action has become a topic of interest in recent years. For example, Scharoun and Bryden (2014) had 3- to 12-year-old children and young adults (Mage = 21.40, SD = 0.75) pick up an overturned glass, and pass it to a researcher to pour a glass of water. Seven to 12-year-olds and young adults re-oriented the glass to facilitate a comfortable beginning state posture for the researcher, such that a glass of water could be poured without further manipulation. Similar observations have been noted with young adults (e.g., Gonzalez et al., 2011; Ray & Welsh, 2011); however, to our knowledge, the effect has yet to be examined in older adults. Nevertheless, recent reports indicate that anticipatory motor planning in independent object manipulation declines in old-older adults (i.e., ages 71+) to levels comparable with 6-year-old children (Scharoun et al., 2015; Wunsch et al., 2015). Therefore, it was hypothesized that old-older adults would perform similar to 6-year-olds in joint action. In the current study, 6- to 11-year-olds, young adults (Mage = 22.86, SD = 1.49), young-older adults (Mage = 64.36, SD = 4.02) and old-older adults (Mage = 75.00, SD = 3.16) performed two actions: (1) pick-up and pass; and (2) pick-up, and pass for use. Each action was performed with a dowel, as if it were an overturned glass or a hammer (handle facing towards the participant). Actual tools were used in subsequent trials. Analysis did not reveal an effect of group, indicating that children ages 6+ consider action requirements of the recipient and plan their movement accordingly. Furthermore, despite evidence of a decline in anticipatory planning skills in independent object manipulation, the performance of old-older adults indicates this is not the case in joint action tasks. Consideration of another's comfort, as opposed to one's own, has been shown to emerge earlier in children (Scharoun & Bryden, 2014). Attributed to social norms, this may also explain why older adults' planning skills appeared preserved.—*The authors would like to acknowledge the Natural Sciences and Engineering Council of Canada (SMS, PJB, and EAR), the Ontario Ministry of Training, Colleges and Universities (SMS), Heart and Stroke Foundation of Ontario (EAR and PJB), and the University of Waterloo (SMS) for funding.*

Object control (throwing, kicking, catching) in older adults
Schott, Nadja, Schuetze, Patrick, University of Stuttgart

Background. Proficient locomotor and object-control skills enable older adults to still participate in typical ball games in a regular sports club or hobby group. These kinds of activities support the older adult in maintaining a physically active lifestyle. However, only limited data are presently available, examining object control skills in this age group. The purpose of this study was to investigate how aging affects qualitative and quantitative parameters in older adults compared to younger ones. Methods. A total of 42 men, of which 22 younger adults (YA; M = 23.5±2.3 years; range 20-27 years) and 20 older adults (OA; M = 69.5±4.4 years; range 62-79 years), took part in the experiment. Throwing, kicking and catching performance was assessed using modified scripts of body component levels from Roberton's developmental sequences. Ball velocity (throwing, kicking) was recorded with a STALKER radar gun. Results. YA (throwing: M = 56.8±9.2; kicking: M = 78.4±9.3) had a higher throwing and kicking speed than OA (throwing: M = 42.0±7.6; kicking: M = 58.2±8.8), $p < .001$, eta2 = .597. Significant age group differences were found in each component of throwing and kicking with the YA group performing at more advanced levels than the OA group. However, no such differences were found for catching. Furthermore, the results revealed that the developmental levels of both throwing and kicking were significantly correlated with the skill-specific velocity (YA: throwing: r = .08; kicking: M = r = .51; OA: throwing: r = .66; kicking: M = r = .73). Overall OA (r = .24 - .75) exhibited higher correlations for all process- and product measures than die YA (r = -.02 - .53). Conclusion. Our data indicate a decline in ballistic, but not manipulative ball skills. While object-control skills are recognized as vital in maintaining motor and cognitive health longer into their lifespan, there are only limited opportunities to participate in complex motor skills for older adults.

The Canadian assessment of physical literacy: A holistic developmental evaluation of 8-12 year old children
Sheehan, Dwayne, Mount Royal University; McCallum, Kyle, University of Calgary

Purpose: The purpose of the study was to examine the physical literacy (PL) of children in multiple education sectors in Calgary through the use of the Canadian Assessment of Physical Literacy (CAPL). Methods: 491 students (female; n=234, male; n=243), aged 8-12-years old (M=10.3, SD=1.5) from both the public school sector, as well as a charter school sector, were assessed using the CAPL. The CAPL tool is a reliable and validated measurement tool that assesses children in four domains, which make up the construct of physical literacy Age, gender and grade level were set as the independent variables. Children were scored in 4 separate domains, which were combined to yield a composite and overall physical literacy score. These domains included; 1) physical competence, 2) daily behaviour, 3) knowledge and understanding, and 4) motivation and confidence. Results: Children's scores were ranked in to one of 4 interpretation score categories: beginning (lower PL scores), progressing, achieving or excelling (higher PL scores). 66% of the subjects fell within the Progressing category for physical competence; 57% fell within the Progressing category for the motivation and confidence domain; 38% fell within the Progressing category for the knowledge and understanding domain; and 59% fell within the Progressing category for the daily behaviour domain. Overall, 63% of children in this sample fell within the Progressing category for Physical Literacy. Conclusion: It appears that the majority of children in Calgary fall within the Progressing category in all but one of the domains as measured by the CAPL assessment tool, indicating that their PL scores were on the lower end of the interpretation score categories.—*Royal Bank of Canada, Participaction*

The effects of optic flows on treadmill-elicited newborn stepping
Siekerman, Kim, Paris Descartes University; Anderson, David I., San Francisco State University; Teulier, Caroline, Paris-Sud University; Barbu-Roth, Marianne, Paris Descartes University

In a recent study we reported that typically-developing 3-day-old newborns take significantly more forward steps on a moving treadmill belt than on a static belt, suggesting the possibility that treadmill-based locomotor interventions for infants at risk of developmental delay could begin at birth. This possibility remains to be tested. Previous experiments have also shown that newborns take significantly more steps on a static surface and in the air when terrestrial optic flows that simulate self-motion forward or backward are projected beneath the infants' feet. The current experiment examined whether treadmill-elicited newborn stepping would be facilitated with the addition of terrestrial optic flows that were congruent or incongruent with the velocity of the treadmill. Twenty-four newborns

were supported on a moving treadmill without additional optic flow (NO OF), or with optic flows that moved in the same direction and at the same speed as the treadmill belt (CONGRUENT), or at a faster speed (FASTER), or were moving at the same speed as the treadmill belt but in random directions (RANDOM). The results revealed no significant differences in the number of forward treadmill steps taken in each condition, $\chi2$ (20) = 1.62, p = .65. However, significantly fewer up-and-down pumping movements of the legs were made in the FASTER condition than in the RANDOM condition, $\chi2$ (20) = 12.1, p = .007. These results suggest that optic flows do not alter treadmill-elicited forward stepping in newborns. The findings are discussed relative to optimal velocities and treadmill surface characteristics for maximizing newborn stepping.

Full-day arm movement data across infancy

Smith, Beth A., University of Southern California

Background: Our overall goal is to use full-day monitoring with wearable sensors to determine quantity, type and quality of infants' limb movements to differentiate typical, delayed and impaired developmental trajectories very early in infancy. Full-day assessment is desirable due to high inherent variability in infant performance and temperament. Here we present preliminary work on daily arm movement produced across infancy in infants with typical development. Methods: We collected data from 19 infants with typical development (1-7 months (m) of age) 1-5 times each, with 1 m between measurements. We collected a full day (ranging from 8-12 hours) of arm movement activity from each infant at each visit. Tri-axial linear acceleration (m/s2) and angular velocity (rad/s) were collected at 20 Hz from wearable sensors on each wrist. We determined area under the curve for the absolute value of the resultant acceleration signal for the period of time the sensors were worn. We normalized the area to the number of hours of awake time to adjust for different lengths of sensor wear and naps. Results: Infants produced mean (M) and standard deviation (SD) 'normalized area' values as follows (average of right and left arms): 1m (n=2) M 16161 SD 3658, 2m (n=4) M 18570 SD 11080, 3m (n=4) M 20112 SD 6143, 4m (n=8) M 20091 SD 7402, 5m (n=8) M 21596 SD 7210, 6m (n=10) M 25648 SD 9275, 7m (n=1) M 19029. Preliminary analysis with a repeated measures linear mixed model supports that "normalized area" values differ significantly across visits ($F_{21,5}$=3.67, p=0.02). Conclusions: Preliminary findings support larger "normalized area" values across visits, indicating more vigorous full day arm movement activity is produced across visits. Infants may be moving their arms more or making faster movements. Our next steps are to determine the frequency and duration of distinct bouts of arm movements across the day, their velocity and acceleration profiles, and if they are uni- or bilateral. We will also determine whether full-day arm movement patterns relate to development of reaching.

Impact of adiposity on physical activity in young infants

Snyder, Kailey E., University of Nebraska at Omaha; Dinkel, Danae M., Kyvelidou, Anastasia, Lee, Jung Min, University of Nebraska-Omaha

Studies suggest that infant adiposity may delay the development of motor skills such as sitting. However, the role of physical activity (PA) in the development of motor skills during the first year of life has been understudied and little is known about the amount of PA needed for normal growth and development in infants. Therefore, the purpose of this study was to examine impact of adiposity as measured by skinfold thickness (SFT) on PA of typically developing infants at three months of age (visit 1), onset of sitting (visit 2), and one month post (visit 3). Twenty-two infants (n=8 high SFT, n=14 lower SFT) participated in a pilot study examining the relationship between infant PA and postural control in normal weight and overweight infants. High SFT was classified as having a subscapular and triceps measurement in the 85th percentile or above according to the WHO age and sex-specific standards. Infant PA was measured using Actigraph Link accelerometers on the left wrist and ankle for four consecutive days at each of the three time points. The PA outcome variable was the average total vector magnitude counts (TVMC) from ankle and wrist accelerometer. Data were analyzed using a repeated analysis of variance and a three way ANOVA to examine the effect of sex, gender, and SFT class (i.e., high vs lower) on TVMC. There were no significant differences in the onset of sitting between the two groups. A repeated measures ANOVA with a Greehouse-Geisser correction determined there were no statistically significant differences in mean TVMC between time points F(1.834, 29.348)=1.111, p <0.338). Post-hoc tests using the Bonferroni correction revealed that infant's PA in the second visit was the higher 5698.91 " 1661.03 TVMC than the first visit 5113.91 " 1661.28 TVMC, p=1.00 and the third visit 5054.31 " 1918.23 TVMC, p=0.89. Additional three-way ANOVA revealed no significant

main effects and interaction effects on sex "SFT" gender). These findings suggest that adiposity may not impact PA in young infants but provide evidence of typical PA levels in healthy infants.

Hopping distance varies by developmental sequences of hopping in children and adolescents

Taunton, Sally, University of South Carolina; True, Larissa, SUNY Cortland; Brian, Ali S., University of South Carolina; Goodway, Jacqueline D., The Ohio State University; Stodden, David F., University of South Carolina

Decreased variability in performance is a hallmark of skill learning/development (Fitts & Posner, 1967), yet transitions in coordination patterns that occur during skill learning/development are marked by stages of stability and instability (Schoner & Kelso, 1988). Thus, variability in performance, as a potential marker of learning, should be contextualized as a function of an individual's relative coordinative stability (i.e, transitional readiness). Developmental sequences define qualitative coordination patterns of specific body components in many fundamental motor skills, and are markers of skill level. As development is age related, lower levels of skill are generally assumed to exhibit decreased performance levels and increased variability. However, studies examining variability in performance among different developmental coordination levels is rare (Urbin, 2013). The purpose of this study was to examine differences in hopping performance levels (i.e., hop distance) and variability in performance as a function of leg action coordination pattern levels (i.e., component levels). Participants (N=129; Girls=65; Ages 4-11) hopping performance (hop distance/ht) and variability in performance across five consecutive hops was assessed. Leg action component developmental sequence levels also were assessed and component level was used as the grouping variable for two separate ANOVA analyses. ANOVA results demonstrated higher component levels were associated with greater hop distance ($F(3, 125)= 7.069$, $p<.001$). Variability in hopping performance was not significantly different across levels ($F(3, 125)= 1.540$, $p<.208$. These data indicated children who demonstrated lower hopping developmental levels, while not able to hop as far, were as stable in their performance as more highly advanced children. Thus, promoting a more advanced coordination pattern (i.e. increased skill) in fundamental motor skills may be difficult, regardless of skill level, as individuals may demonstrate similar states of stability across skill levels.

Exploring strength and hypermobility in children without joint hypermobility syndromes across a spectrum of movement proficiency.

Thornton, Ashleigh L., The Univesity of Western Australia; Wright, Kemi, Licari, Melissa K., Furzer, Bonnie J., The University of Western Australia

In the exploration of issues impacting movement proficiency in children, an emerging factor that warrants consideration is hypermobility. Joint hypermobility (JH) is associated with muscle weakness, and this is said to potentially impact motor development. This study aimed to examine the relationship between hypermobility and strength across children with varying movement proficiency. Sixty four children (M age 7.91±1.5 yrs) participated. Movement proficiency (MP) was assessed via the Movement Assessment Battery for Children-2 (MABC-2). Hypermobility measures included the Beighton score and the Lower Limb Assessment Score. Strength was assessed using 5-repetition maximum (5RM) strength tests, the Resistance Training Skills Battery for Children (RTSBc) and peak torque of the knee flexors and extensors were assessed isometrically and isokinetically using a Biodex dynamometer. Based on revised Beighton criteria, 17% of children were classified as clinically hypermobile. Sequential regression analysis was performed, with strength variables entered on the first step, and hypermobility on the second step; MP was the criterion variable. On the first step, strength variables collectively explained 41% of the variance in movement proficiency ($F(6,63) = 8.311$, $p <.01$), with RTSBc ($\beta = .479$, $p < .001$) and 5RM ($\beta = .278$, $p = .019$) emerging as positive significant predictors. On the second step, hypermobility failed to explain significant variance in movement proficiency beyond that explained at step one (R squared change = .002, F change (1,56) = .158, $p = .692$). Consistent with previous research, results show that strength may be an important predictor for movement proficiency; however, contrary to previous literature, hypermobility did not explain any further variance in movement proficiency scores. Investigations into the effects of hypermobility on strength and MP previously have used children with JH syndromes, and the present study provides evidence to suggest that movement limitations associated with hypermobility may be exclusive to these clinical populations.

Posture, locomotor skill onsets, and spatial exploration in infants: A longitudinal study
Thurman, Sabrina L., Corbetta, Daniela, University of Tennessee Knoxville

The onset of locomotion influences the way infants interact with their environments (e.g., Campos et al., 2000). Here, we examine how changes in posture and locomotor skills - creeping and walking - relate to patterns of spatial exploration in 10-min free-play sessions. Thirteen infants and their mothers were observed twice monthly in a laboratory setting, from 6 to about 17 months. The 11 X 12 ft. room contained toys, colorful 1-sq.-ft. foam tiles, a couch, and a small set of stairs. Changes in gross motor skills were captured with Touwen's Assessment of Motor Behavior. Postures (laying down, sitting, on all fours, kneeling, creeping, standing, cruising, and stepping) and location coordinates for the infant were video-coded at 30s intervals. From the coordinates, we derived the infant's total distance traveled and dispersion from the point of central tendency. Results showed that infants increased the distance traveled and dispersion in the room after creeping onset ($p<.001$; $p<.001$), and even more as they became expert creepers ($p<.000$; $p<.000$), but not after walking onset. Therefore, as distance traveled increased, so did dispersion as infants visited more spatial locations in the room. Even through these transitions, infants still displayed many postures. We examined how the number of changes in posture in each session related to spatial exploration. Spearman correlations performed on each infant individually revealed that the number of changes in posture correlated positively with distance traveled in 10/13 infants (p-values=.000-.034). Thus, as infants traveled more, they also more likely transitioned across different postures, presumably as the result of their active exploration of the room and objects in it. For dispersion, 8/13 infants displayed a significant positive correlation with the number of postural changes performed (p-values=.000-.047). Our data provide evidence that creeping onset and moment-to-moment postural changes during a free play session importantly mark the beginnings of increases in infant spatial exploration of their surroundings.

The development of a holistic testing battery for talent identification in field hockey
Timmerman, Ewout, Victoria University; Savelsbergh, Geert J.P., Vrije Universiteit; Farrow, Damian, Victoria University

The search for and quantification of talented field hockey players in Australia starts at the age of 12 years and is predominantly based on subjective measurements. The little objective research that is available for talent identification in field hockey has focused on the influence of physical characteristics (Elferink-Gemser et al., 2004). Whilst it has been found that several physical abilities were advantageous for selection into a representative team, field hockey is a multidimensional sport and as such any testing battery should incorporate all of these characteristics (i.e., technical skills, physical characteristics, decision-making, and psychological traits) to create a useful tool for selectors. Consequently, this study developed a holistic testing battery for talent identification and talent monitoring purposes in field hockey. A total of 205 field hockey players aged 9.0-17.8 years (45.8% girls) completed body composition measurements (height, weight, body fat % and age at peak height velocity), skill tests (passing, hitting and dribbling), physical tests (grip strength, jump height, sprinting speed, agility and beep test), a decision-making test and self-regulation and developmental history questionnaires. A series of MANOVA's followed up with discriminant analysis were used to evaluate any differences between age groups (U13, U15, Open age) and playing level (i.e., club or state). Preliminary results revealed differences in several performance measurements for playing level and age group. Discriminant analysis showed that dribbling skill and hitting skill differentiated most between playing level for boys and dribbling skill and age at peak height velocity differentiated most between playing level for girls. The discussion will focus on the contribution of different performance characteristics on playing level, age and gender as player's progress along a talent development pathway. This study highlights the potential of using a holistic testing battery for talent selection and monitoring purposes and the prioritization of development needs.—*Victoria University and Hockey Australia*

Motor competence and sedentary time in 9-10 year-old children
True, Larissa, SUNY Cortland; Pfeiffer, Karin A., Smith, Alan, Kagerer, Florian, Gerlach, John, Branta, Crystal F., Michigan State University

A positive relationship between motor competence (MC) and physical activity (PA) is evident in youth (Logan et al., in press), but the relationship between MC and objectively-measured sedentary time requires study because

sedentary behavior has recently been recognized as its own entity rather than a behavior that is simply the opposite of PA. Object control skills are more complex than locomotor skills and require elements of fitness (e.g., strength, endurance) as well as total body coordination (e.g., balance, temporal and spatial accuracy). Children without prerequisite object control skills to participate in sports and games may acquire more sedentary time than children with developmentally- appropriate levels of MC. The purpose of this study was to examine the association between MC and sedentary time in 9-10 year-old boys and girls (n = 105). Gross MC was assessed using locomotor and object control skill scores from the TGMD-2 (Ulrich, 2000). Participants wore an ActiGraph GT3X accelerometer for seven days (at least four of which were included in analysis) to assess sedentary time. Complete data were obtained from 82.9% of children. Boys spent less time sedentary (57.4%) than girls (62.4%), and boys scored higher than girls on the object control subtest (M = 39.2 vs 32.1; $p < .05$) and locomotor subtest (M = 42.0 vs 40.3; $p < .05$). Object control and locomotor scores were examined in separate regression models along with BMI, SES, race, and sex as predictor variables. The overall object control model was significant, $F(5,81) = 3.86$, $p < .005$, $R2 = .19$, with object control the sole contributor to the model (6 = -.21; $p = .04$). The overall locomotor model was also significant, $F(5,81) = 3.49$, $p < .01$, $R2 = .18$, with sex as the only contributor to the model (6 = -.30; $p = .005$). These findings suggest that object control skills, but not locomotor skills, are inversely associated with sedentary time. Future work is warranted that explores the potential value of promoting object control skills in the interest of reducing sedentary time.—*NASPSPA Graduate Student Research Grant (2013)*

Reliability of physical activity measurement in infants: A Generalizability study to determine minimal days and hours of monitoring

Ulrich, Dale A., Pitchford, E. Andrew, Ketcheson, Leah, Kwon, Hyun Jin, University of Michigan

Objective: There is a critical need for health promotion to increase physical activity and reduce sedentary behaviors during infancy. However, there is little evidence to support how physical activity should be measured during the first year of life. The purpose of this study was to utilize Generlizability (G) theory to determine the minimal number of days and hours of accelerometry needed to reliably measure daily physical activity in infants. Methods: A total of 17 infants (10 F, 7 M), all non- walkers, average age of 5.76 (SD = 3.67) months, participated in the study. Infants wore an Actigraph GT3X-BT triaxial accelerometer on the right ankle for seven consecutive days. Data were manually cleaned to remove activity counts not produced by the infant. G- theory studies (one-facet fully-crossed) using variance component analysis were conducted on the average one- minute vector magnitude counts. Results: The G-theory analysis identified that physical activity monitoring of 11 or more hours (G = .805, Phi = .806) on 2 or more days (G & Phi = .892) produced acceptable reliability coefficients greater than 0.80. These findings designate the minimal guidelines of physical activity monitoring advised for future studies. Variance components for the Hours facet included Participants (28%), Hours (<1%), and the interaction plus any unexplained error (71%). The Days facet had variance components for Participants (75%), Days (<1%), and the interaction plus unexplained error (25%). The components signify that most variance was due to individual differences in activity counts between participants, as should be expected. Conclusion: These results provide some of the first guidelines for developing a protocol to objectively measure physical activity during infancy. Accelerometer monitoring periods of at least 2 days and 11 hours appear to be sufficient for reliable measurement. Research measuring and intervening upon physical activity behaviors during infancy is of great need and has potential to improve trajectories of weight gain, motor development, and physical health.

Does self-enhancement in motor skill competence and health-related fitness promote physical activity?

Utesch, Till, University of Münster; Dreiskämper Dennis, University of Münster; Geukes, Katharina, University of Münster; Naul, Roland, Willibald Gephardt Institute Essen

Introduction. A large body of research examines the relationship between perceived and actual motor competence (MC) and health-related fitness (HRF) as important factors for promoting physical activity (PA) and subsequently improving health (cf., Stodden et al., 2008). The overestimation of actual MC and HRF is labelled self-enhancement and it is unclear how it affects PA. This study investigates these self-enhancement-effects of perceived and actual MC as well as of perceived and actual HRF on PA. The effects of cross-sectional and longitudinal models are compared. Methods. A total number of 1699 students (age: M = 9.5, SD = .72) participated in both the 3rd and 4th grade. MC (7 items) and HRF (4 items) were measured product-oriented. Perceived motor competence was assessed

via the physical self-concept (PSC; 5 dimensions) and PA via a composite index (11 items). A Response Surface Analysis, which accounts for level as well as for discrepancy, was conducted for each MC and HRF item and its corresponding PSC dimension as predictors. Results. Overall, differences between the cross-sectional and longitudinal models were identified. In the cross-sectional models, only the perceived MC showed a main effect on PA (.14 < beta < .23). In the longitudinal models, a main effect was found for the actual MC (.11 < beta < .17). No interaction effects and no self-enhancement effects were found, neither cross-sectionally (06. < LOC < .1; 02. < LOIC < .09), nor longitudinally (.059 < LOC < .92; -.05 < LOIC < .06). Conclusion. Cross-sectionally, self-concepts are positively associated with PA, whereas, longitudinally, actual MC and HRF levels promote PA, irrespective of the self-concept. Neither overestimating nor underestimating one's own competencies substantially affect future PA. Future studies investigating the longitudinal mechanisms underlying the effects described in the conceptual model of Stodden et al. (2008) should be extended to include process- as well as product-oriented assessments and the perception of MC and HRF.

Relationship between children's knowledge of skill cues and their motor skill performance

Valentini, Nadia C., Universidade Federal do Rio Grande do Sul; Hastie, Peter A., Rudisill, Mary E., Auburn University

Research investigating mastery climates (Valentini, Rudisill & Goodway, 1999) and play (Bar-Haim & Bart, 2006) has emphasized the importance of cognitive engagement in learning, particularly the use of verbal cues for the purpose of strengthening self-instruction skills (Janelle, Champenoy, Coobes & Mousseau, 2003). What has been missing however is evidence of a positive relationship between children's knowledge of skill cues and their motor skill performance. The purpose of this study was to examine the relationship between children's verbal recall of skill specific cues and their motor skill performance. Forty-six children with developmental delay from 27 public schools in Brazil completed the Test of Gross Motor Development-2 (TGMD-2) as well as a verbal recall checklist based upon the TGMD-2 skill components. The logistic regression model was statistically significant for all six locomotor skills, with the model correctly classifying between 70% to 84% of cases. The model correctly classified nearly 70% to 80.4% of cases. The logistic regression model was statistically significant for four object control skills (dribble, p = .011; catch, p = .007; throw: p = .001; and roll, p = .002). However, it was not significant for strike (p = .055) or kick (p = .330). Overall, the model correctly classified between 70% to 74% of the cases. In summary, for the majority of skills, children who could state the appropriate cues were up to 2-to-17 times more likely to have mastered their skills.

Validity and reliability of two short forms of the Test of Gross Motor Development-2

Valentini, Nadia C., Universidade Federal do Rio Grande do Sul; Rudisill, Mary E., Auburn University; Bandeira, Paulo F., Universidade Federal do Rio Grande do Sul; Hastie, Peter A., Auburn University

The Test of Gross Motor Development-2 (TGMD-2) is a popular assessment and used by many experts in the field, although one of its limitations is the time it takes to deliver and code assessments. The aim of this study was to examine the validity and inter-rater reliability of a short form of the Test of Gross Motor Development - Second edition (TGMD-2; Ulrich, 2000) for the assessment of 3 to 10 year-old children. Data from 2,463 Brazilian children were analyzed using two different statistical procedures. In the first analysis, the Classical Test Theory (factor analysis) was applied using exploratory and confirmatory factor analysis to investigate the validity of reducing the number of skills assessed within the TGMD-2. In the second analysis, Item Response Theory was used to determine if certain behavioral components assessed within each skill could be deleted. The results showed that a version reduced to six skills has appropriate indices of confirmatory factorial validity, internal consistency, and inter- and intra-rater reliability. In the second analysis, performance criteria for the locomotor subtest and 13 from the object control subtest failed to present adequate discrimination power and level of difficulty, and were subsequently removed from the test. All the performance criteria for leap and underhand roll were eliminated. The other 24 performance criteria results had adequate fit and were included in the model. From these findings, researchers and practitioners now have two valid and reliable shorter options of the TGMD-2 for use in assessing children's motor skill competence. This should promote wider and more efficient use of the test for both research and screening purposes.

Content and construct validity and reliability of the pictorial scale of perceived competence and social acceptance for Brazilian young children

Valentini, Nadia C., Universidade Federal do Rio Grande do sul; Bandeira, Paulo F ., UFRGS; Rudisill, Mary E., Auburn University

The Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA) is a scale used to identify self-perceptions of competence (i.e., cognitive and physical) and social acceptance (i.e., peers and maternal) of children in kindergarten, first and second grades of elementary school. The objective of this study was to translate and investigate the content, criteria and construct validity, and reliability of the PSPCSA for Brazilian children. The cross-cultural translation was used, and the process of validation was conducted involving 33 professionals and 667 children (4 to 7 years-old). On two occasions, 159 children answered the PSPCSA. The results revealed that the scale has clear and pertinent questions, high internal consistence (values > 0.96) and test-retest reliability (r values> 0.60). The PSPCSA showed adjusted adhesion of the questions with the correspondent dimensions and subscales, and satisfactory indices of the confirmatory factorial validity (Non-normed Fit Index, Comparative Fit Index and Tucker e Lewis's Index of Fit with values > 0.81). The Brazilian versions of PSPCSA are valid and reliable to be used with Brazilian children.

Motor proficiency in Brazilian children using TGMD-3: Age & sex differences

Valentini, Nadia C., Universidade Federal do Rio Grande do sul; Zanella, Larissa W., Bandeira, Paulo F R., Nobre, Glauber C., UFRGS; Gonzalves, Marcelo D., Federal University of Amazonas; da Silva Sousa, Francisco C., University Catolica Rainha do Sertao & Federal Institute of Education, Science and Technology

Fundamental motor skills (FMS) acquisition and proficiency occurs during infancy (3-to-10 year-old) influenced by context opportunities; consequently, differences in motor competence have been reported for boys and girls at different ages. The objective of the present study was to investigate the sex differences on locomotion and ball skills along childhood and describe the levels of motor competence (low, median, mastery) among Brazilian children. The Test of Gross Motor Development third edition was used to assess near 800 children (3 to 10 years-old) from five states of Brazil. The results showed that: (1) boys are more proficient than girls on run and in the majority of ball skills, with exception of catch; (2) children showed plateau and/or very little improvement very early in childhood (run and hop: at 6 year-old; gallop, jump, strike with two hands and kick: at 7 year-old; slide, catch, over- and under-hand throw: at 8 years-old; strike with one hand and dribble: at 9 year-old); (3) low motor proficiency still present at age 10 year-old; and, (4) mastery was only achieved by a small number of children. The findings related to low motor proficiency and mastery, combined with the significant differences in the raw scores suggests that girls may be more vulnerable to developmental motor delays. Boys and girls are failing to achieve mastery during the childhood years; and, as they get older the risks for delays are more established.

Validity of the affordances in the home environment for motor development in daycare setting

Valentini, Nadia C., Universidade Federal do Rio Grande do sul, Alessandra B., UFRGS & UNISINOS; Bandeira, Paulo F., UFRGS

The range of stimuli provided by physical space, toys and care practices contributes to the motor, cognitive and social development of children. However, assessing the quality of child education environments is a challenge, and can be considered a health promotion initiative. This study investigated the validity of the criterion, content, construct and reliability of the Affordances in the Home Environment for Motor Development - Infant Scale, version 3-18 months, for use in a daycare setting. Content validation was conducted by seven motor development and health experts, and face validity by 20 specialists in the areas of health and education. The results indicate the suitability of the adapted instrument, evidencing its validity for the daycare setting, with assessment value for the opportunities that the collective context offers to child development.

Construct validity and reliability of the pictorial scale of perceived movement skill competence for Brazilian young children

Valentini, Nadia C., Universidade Federal do Rio Grande do sul; Bandeira, Paulo FR., Nobre, Glauber C., Zanella, Larissa W., UFRGS; Sartori, Rodrigo F., UFRGS & PUCRS & Serra Gaucha School; Ribeiro, Priscila A., School Leao Sampaio

Introduction: The Pictorial Scale of Perceived Movement Skill Competence for Young children - PSPMC-YC (Barnett et al., 2016) is an assessment developed to assess children perceptions of competence in locomotor and object control skills and in active play. Objectives: Translate the PSPMC-YC to Brazilian children and investigate its psychometric properties concern with construct validity and reliability. Method: Four translators conducted a back-reverse translation; six experts using a Likert scale judge the clarity and pertinence of the scale" items; 19 health-related professionals were enrolled in face validity; and, preliminary 217 children (4 to 8 years-old) were assessed to investigate PSPMSC-YC construct validity. The latent structure of the Brazilian Version of the PSPMSC-YC was tested through confirmatory factor analysis (CFA) similar to the three factor model tested with 4 and 5 year-old" Australian children (Locomotor Skills: Gallop, Hop, Jump, Leap, Run, Step Slide; Object Control Skills: bounce, catch, hit, throw, kick, roll; Active Play: Bike, Board Paddle, Climb, Skate/Blade, Scooter, and Swim); internal consistency was conducted using polychoric correlation-based alphas; and, Pearson's correlation was used to investigate test-retest reliability. Results: the experts judge the clarity of the items adequate and pertinence satisfactory; concerns were raised about some activity play items. Face validity and test-retest reliability were also satisfactory (r values> .70). The CFA final model with the original 18 items hold 3-factor with adequate good fit indices (GFI= .90; CFI= .80; RMSEA=.05). Internal consistence analysis showed Alpha reliability values (Locomotor Skills = .88; Object Control Skills = .75; Active Play = .72). Conclusion: The preliminary results suggested that the Brazilian PSPMC-YC is a valid and reliable instrument and its accessibility in Brazil will contribute to research outcomes and practice interventions.

Motor competence and physical activity levels of children: the interdependence of multiples factors

Valentini, Nadia C., Universidade Federal do Rio Grande do sul; de Souza, Mariele S., Bandeira, Paulo FR., UFRGS

Motor competence is essential to maintain appropriate levels of health- related fitness. However this relationship may be influenced by other factors interrelated to child development. Our objective was to investigate the associations between motor competence (MC) in Fundamental Motor Skills (FMS) and physical activity levels (PAL) with body mass index (BMI), perceived motor competence (PMC), sex and age of children. The participants were 290 boys and 294 girls from 3 to 10 year-old form public schools in four main cities from the south of Brazil. The TGMD-2 was used to assess motor performance. Pedometers in physical education classes were used to mesure the physical activity levels. We also assessed body mass index and children perceptions of competence. A multivariate multiple linear regression-model was conducted between the variables PAL and MC in FMS (dependent variables) and the gender, age, BMI, and PMC (independent variables). Maximum likelihood was estimated using AMOS. Possible Variance Inflation Factor (VIF) was calculated to assess multicollinearity assumptions. Results suggested that there was no multicollinearity between the independent variables (VIF <5). Adjusted final model explained 65% and 30% of the variability of the variables for MC and PAL, respectively. The trajectories FMS X sex (b = - 6.22; SEb = .76 p < .001) FMS X Age (b = 6.34; SEb = .21 p < .001), FMS X Pmc (b = .44; SEb = .12, p < .001) and FMS X IMC (b = - .48; SEb = .112, p < .001) were statistically significant; and the trajectories. PAL X Sex (b = - 15.196; SEb = 1.78, p < .001) PAL X Age (b = 6.04; SEb = .49, p < .001), PALX BMI (b = -.72; SEb = .26, p = .006) were also significant. The motor competence in fundamental motor skills and physical activity levels are associated with multiple factors, understand these relations in the short and long term are essential for better planning of physical education classes for leisure, sport and health promotion.

Physical activity levels of preschoolers and early childhood education students during outdoor play sessions at a university lab school

Wall, Sarah J., Culpepper, Dean, Birky, Beth, Gard, Elaine, ENMU

Active Start guidelines recommend 60 minutes of structured physical activity (PA) per day and caregivers who are knowledgeable about the importance of PA. Early Childhood Educators (ECE) cite lack of training in PA/physical education as a barrier to promoting PA, and perceive safety and supervision as their main role on the playground rather than the promotion of PA. The primary purpose was to investigate preschoolers PA levels during playground time; additionally examining ECE students' perceptions of their own PA levels on the playground. Preschoolers (15 males; 14 females) were videotaped over 13 sessions and PA behavior analyzed using SOPLAY. Twelve ECE students were given instructions to engage with the children and support safety. ECE students were questioned as to their perceived MVPA prior to wearing an Actiheart® monitor during three sessions on the playground. Preschoolers were in MVPA an average of 55% of the playground session. Ten of the ECE students believed they would maintain MVPA for the majority of the outdoor session but only 36% engaged in MVPA. ECE students have inaccurate perceptions of their level of physical activity while on the playground and are not stimulating high levels of physical activity in the children during playground time.—*Eastern New Mexico University faculty internal grant*

Comparison of two motor assessments: Test of Gross Motor Development - 3rd edition and Movement Assessment Battery for Children - 2nd edition

Webster, Elizabeth K., Louisiana State University; Ulrich, Dale A., University of Michigan

Objective: Criterion-prediction validity is an essential component of test creation to ensure that a new assessment correlates well with an established assessment known to evaluate similar components or abilities. The purpose of this investigation is to examine the concurrent validity of the Test of Gross Motor Development, 3rd edition (TGMD-3) to the already validated Movement Assessment Battery for Children, 2nd edition (MABC-2). Methods: 51 children (M age = 6.37±2.31 yrs; 47.4% male) were evaluated using the TGMD-3 and the MABC-2. Concurrent validity was examined by partial correlations, controlling for age, among the subtests for the TGMD-3 (locomotor, LM; ball skills, BS) raw scores and MABC-2 (manual dexterity, MD; aiming & catching, A&C; balance, BAL) standard scores, as well as total scores for both assessments. Results: Significant partial correlations were found between the A&C subscale standard score and LM ($r = .49$, $p < .011$), BS ($r = .49$, $p < .001$), and total TGMD-3 ($r = .43$, $p = .002$). MD and BAL subscales did not significantly correlate with the total TGMD-3 scores, nor the LM and BS subscales. Total TGMD-3 raw scores and MABC-2 standard scores were not significantly correlated ($r = .268$, $p = 0.06$), but neared significant levels. MABC-2 standard score was significantly correlated with BS performance on the TGMD- 3 ($r = .28$, $p = .04$). Conclusion: The A&C subscale measures similar items to those on the BS subscale of the TGMD-3. Therefore, moderate correlations were appropriately found between the A&C subscale of the MABC- 2 and total TGMD-3 scores, as well as LM and BS subscales. The weak correlations between total TGMD-3 and MABC-2 scores indicate that holistically, the two assessments do not closely match. High amounts of overlap would be indicative of the two examinations testing the same variables/constructs; the TGMD-3 measures fundamental motor skills, the MABC-2 measures motor abilities. Further work is needed to evaluate concurrent validity of the TGMD-3 with various established motor assessments.

Relationship between motor skill competency and body composition in children

Webster, Elizabeth K., Louisiana State University; Robinson, Leah E., University of Michigan

Objective: Body Mass Index (BMI) is a widely used measurement for body composition, but it fails to account for more detailed components of weight including fat mass, fat percentage, and fat free muscle mass. The purpose of this investigation is to examine the relationship between body composition (i.e., fat mass [FM], fat percentage [F%], and fat free mass [FFM]) as measured by bio-electrical impedance analysis and motor skill competency in Kindergarten through 2nd grade students. Methods: Ninety-one students (M = 6.89 " .96 years; 54.9% male) completed the Test of Gross Motor Development " 2nd edition (TGMD-2) and body composition was assessed with the Tanita SC-3315 Body Composition Analyzer. Backward elimination regressions examined what body composition factors explained the most variance in TGMD-2 scores, as well as the locomotor (LM) and object control (OC) subscales. Correlations between the body composition variables and BMI were also conducted.

Results: F% and FFM were the best predictors of total TGMD-2 performance (F(2,88)=7.181, p <.001) accounting for 12% of the variance. For LM skills, F% and FM were the best predictors (F(2,88)=6.59, p = .002) and accounted for 13% of the variance. For OC skills, F% and FFM were the best predictors (F(2,88)=5.56, p = .005), explaining 11.2% of the variance. BMI was significantly correlated with F% (r=.74, p<.001), FM (r=.78, p<.001), and FFM (r=.66, p<.001). Conclusion: The findings expand the current understanding of the relationship between body composition and motor skill competency in children. There is a high level of correlation between BMI and body composition variables; separating specific aspects of body composition may be imperative in addressing morphological constraints that may deter acquisition of fundamental motor skill competency. Additionally, different types of motor skills (i.e., LM and OC) presented different predictors for motor performance. Further investigation is warranted and can help inform motor skill interventions.

Infants show a preference for social images in the first year of life

Wickstrom, Jordan, University of Nebraska-Omaha; Ambati, Pradeep, University of Nebraska at Omaha; Wehrle, Lauren, Senderling, Benjamin, Kyvelidou, Anastasia, University of Nebraska Omaha

The increasing occurrence of autism spectrum disorders (ASD) creates a crucial need for clinicians to identify ASD-related deficits as early as possible so that children may receive access to intervention services as early as possible. Currently, the typical age of diagnosis for ASD is around three years of age. However, signs of atypical behavior have been documented retrospectively by parents as occurring earlier than this three-year mark. It has been suggested that gaze behavior could be a useful marker of developmental disruption in children with ASD. A very simple method, known as the preference looking paradigm, has been utilized successfully in toddlers as young as 14 months for the identification of ASD, but it has not been tested in infants. Therefore, the purpose of this study was to investigate the gaze behavior in typically developing infants and infants at-risk for autism at three, six, nine, and twelve months of age. Identifying early preferential looking differences in infants may allow for an increased understanding of the underlying visual processes, the development of an early detection paradigm for autism, and the advancement of foundational knowledge from which treatments for autism may be developed. Ten typically developing infants and one at-risk infant were examined in this study longitudinally. An infant was defined as at-risk if he/she had a sibling diagnosed with autism. Each infant was shown a preferential looking paradigm with dynamic social images shown on one side and dynamic geometric images on the other side. Results showed that both typically developing infants and the infant at-risk showed a preference for social images and that preference increased with age. Even though these preliminary results do not confirm our initial hypothesis, it is possible that even though infants at-risk do prefer social images they do not perceive the social information from those images as do typically developing infants. Further research in this area is needed to verify these findings.

Collecting concurrent validity, reliability of classification decisions, inter and intra-rater reliability evidence for the Furtado-Gallagher Computerized Observational Movement Pattern Assessment System (FG-COMPASS)

Woolever, Mackinsey, Furtado Jr., Ovande, California State University, Northridge

Fundamental movement skills (FMS) are considered the building blocks for the development of specialized skills. In addition, fundamental movement skill competency has been linked to decreased levels of obesity and increased levels of physical activity/sport participation. Thus, teachers and practitioners working with younger children must conduct regular assessments to gather evidence about the student's level of achievement in fundamental movement skill (FMS) development. This study aimed to collect evidence for concurrent validity, reliability of classification decisions, and inter/intra-rater reliability for the FG-COMPASS. The FG-COMPASS is a process-oriented and criterion-referenced instrument that evaluates FMS development in children ages 5 to 10 years. The Test of Gross Motor Development 2 (TGMD-2) was used as "gold standard" for concurrent validity. Participants were 34 children between the ages of 5 and 10 years. Partial Pearson correlations (controlling for age) comparing the scores of both tests indicate a moderate to strong correlation for locomotion (rxy.z =.52, p < .01), object manipulation (rxy.z =.59, p < .001), and total scores (rxy.z =.63, p < .001). The reliability of classification decisions was assessed by comparing the live score ratings of five raters with the primary investigator's video scores on 10 randomly selected children per skill. The inter-rater reliability was assessed by comparing the scores across the FG-COMPASS 5 raters. The intra-rater reliability was assessed by comparing each FG-COMPASS rater's live scores to their video

scores. The weighted kappa scores ranged from .57 to .89, .50 to .89, and .58 to .90 for the reliability of classification decisions, inter and intra-rater reliability, respectively. The results of this study provide further validity and reliability evidence for the FG-COMPASS. Further studies involving children with different ethnicity backgrounds and a larger sample size is recommended.—*CSUN Thesis Support Program - Research and Graduate Studies*

Examining the impact of physiological characteristics and generalised self-efficacy on children's physical activity levels across the movement proficiency spectrum: Preliminary findings

Wright, Kemi E., Thornton, Ashleigh L., Licari, Melissa K., Naylor, Louise H., Reid, Siobhan L., Furzer, Bonnie J., The University of Western Australia

In comparison to typically developing (TD) children, recent research has identified children with low movement proficiency (LMP) as having lower levels of physical activity (PA), lower aerobic fitness, increased body fat and/or low muscle strength (MS). To date, the relationship between these variables in children with LMP is not well understood. Sixty four children (M age 7.91"1.5 yrs) participated in the study. Movement proficiency (MP) was assessed via the Movement Assessment Battery for Children-2 (MABC-2); 41 children were classified as TD according to MABC-2 scores, with 10 classified as having "possible difficulties" and 13 probable DCD (pDCD). Dual Energy X-ray Absorptiometry scans were used to determine body composition. Strength was assessed using handgrip and 5-repetition maximum (5RM). Hypermobility was assessed using the Beighton Score and PA using Actigraph GT3x accelerometers. Children also completed the Children’s Self- perceptions of Adequacy in and Predilection for Physical Activity scale (CSAPPA) to establish generalised self- efficacy towards PA. Peak aerobic capacity (Vo2peak) was determined using an incremental treadmill protocol using a portable analyser. MP was found to correlate moderately with total 5RM score ($r=.504$, $p<.01$) and the CSAPPA subscores of; Predilection ($r=.587$, $p<.01$), Enjoyment ($r=.341$, $p<.01$) and Adequacy ($r=.459$, $p<.01$). Analysis of variance revealed total 5RM score differed significantly between groups ($F(2,61)=7.843$, $p< .05$), with TD children stronger than those with possible difficulties ($p = .021$) and pDCD ($p < .05$). Predilection ($F(2,61)=13.768$, $p< .001$) and Adequacy ($F(2,61)=7.989$, $p< .001$) scores were significantly higher in TD compared to the pDCD group. Contrary to the current literature, there appears to be no difference in physiological capacity or PA in the present study between LMP and TD children, with the exception of MS. However, in line with previous research there is a difference in some elements of generalised self-efficacy, but it appears within this sample this has no direct impact on current PA.—*UWA Paediatric Exercise Health Research Group*

Sport and Exercise Psychology

Psycho-affective alteration and cognitive deficit in slow to recover athletes

Alarie, Christophe, Moore, Robert D., Letourneau, Marc, Lefebvre, Frederique T., Martin, Sophie, Prevost, Jeremie L., Ellemberg, Dave, University of Montreal

Although the majority of concussed athletes are believed to recover within 7 to 10 days following the injury, up to 20% of concussed individuals will experience persisting symptoms (McCrory, 2013). However, little is known about the psycho-affective state and cognitive performances of slow to recover athletes (SRA) relative to asymptomatic athletes with a history of concussion (ACA) and without a history of concussion (NHC). Accordingly, the current study sought to compare the psycho-affective health and cognitive performance of SRA, ACA and NHC athletes. Twenty SRA were matched for age, gender, time since injury (mean = 49.3, SD = 40.0 days) and number of injuries (m = 2.2, SD =1.3 concussion) with 20 ACA, and for age and gender with 20 NHC. All participants completed the Beck's Depression Inventory-II (BDI-II) and the Profile of Mood State (POMS). Athletes also completed a computerised N-Back task to measure working memory. Analyses of BDI-II scores revealed that SRA exhibited significantly greater depressive symptoms than ACA and NHC (p = < 0.05). ACA did not differ from NHC. Analyses of the POMS revealed that SRA significantly differed from ACA and NHC for Depression-Dejection, Anger-Hostility, Vigor-Activity and Confusion-Bewilderment subscales, as well as total mood disturbance (p = < 0.05). ACA did not differ from NHC for any POMS subscale or in terms of total mood disturbance. Analyses of the N-back task revealed that SRA had significantly longer response time and lower response accuracy on the N-back relative to NHC (p = < 0.05), but not ACA. ACA did not cognitively differ from NHC athletes. The current results suggest that athletes with persistent symptoms have a worse emotional status and reduced cognitive performance relative to asymptomatic athletes with and without a history of concussion. Moreover, these results indicate that psycho- affective questionnaires and cognitive testing might be useful to track recovery and aid the clinical management of athletes with persistent symptoms.—*CIHR*

Effect of sub-maximal aerobic exercise on psycho-affective outcomes in athletes with persistent post-concussion symptoms

Alarie, Christophe, Moore, Robert D., Letourneau, Marc, Lefebvre, Frederique T., Martin, Sophie, Prevost, Jeremie L., Ellemberg, Dave, University of Montreal

Many athletes participating in contact sports will incur a concussion during their career. Up to 20% of concussed athlete will have a complex recovery exhibiting persisting post-concussion symptoms and psycho-affective alterations (McCrory, 2013). Emerging research indicates that progressive exercise protocols may be of therapeutic utility for slow to recover athletes. Therefore, we sought to assess the effectiveness of a progressive sub- maximal aerobic exercise protocol for reducing clinical symptoms and psycho-affective alterations. Nine concussed athlete with persisting symptoms (6 female and 3 male; m = 28.7 SD 14.5 days since injury) underwent a progressive exercise protocol. Athletes began at ~50% of their theoretical maximal heart rate, and progressed by ~5% of their heart rate every 7 days. The mean duration of intervention was 83.4 days (SD 40.2). Before and following the intervention, athletes completed a series of questionnaires including: the Post-Concussion Symptoms Scale (PCSS), the Beck's Depression Inventory-II (BDI- II), the Beck's Anxiety Inventory (BAI) and the Profile of Mood State (POMS). Analyses of PCCS revealed that the overall symptom intensity was significantly reduced following the intervention (pre- 36.9; SD 14.4; post- 5.3; SD 4.35; p < 0.01). Analyses of BDI-II scores revealed that depression was significantly reduced following the intervention (pre- 15.0 SD 7.7; post-; 9.44 SD 5.9; p= < 0.05). Likewise, analyses of BAI scores revealed that anxiety was significantly reduced following the intervention (pre- 9.6 SD 5.0; post- 5.11 SD 4.1; p= < .05). Lastly, analyses of the POMS revealed that total mood disturbance was significantly reduced following the intervention (pre- 54.6 SD 28.5; post- 23.8 SD 29.2; p < 0.05). Together the current results suggest that progressive sub-maximal aerobic-exercise protocols can be effectively used to manage persisting clinical symptoms and psycho-affective disturbances following concussion—*CIHR.*

Knowledge and routines of NCAA hockey coaches during intermissions

Allain, Julia I., Bloom, Gordon A., McGill University; Gilbert, Wade D., California State University, Fresno

Intermissions are a short period of time in the middle of competition where the coach has the opportunity to interact with their assistant coaches, adjust their game plan, and address their team as a whole (Bloom, 1996). According to expert coaches, proper use of this critical time in competition is a learning process that improves with experience and relies on multiple contextual factors (Bloom, 1996). While research has demonstrated significant planning and thought behind the behaviors of coaches in competition (Bloom et al., 1997; Debanne & Fontayne, 2009; Smith & Cushion, 2006), coach knowledge and routines during intermissions have yet to be the main focus of study. The purpose of this study was to examine the knowledge and routines of coaches during intermissions, as well as the factors that influenced their individual and team interactions. Six highly experienced and successful NCAA Division I hockey coaches were purposely sampled and interviewed. The two-part interview process included a semi-structured interview and a stimulated recall interview. The purpose of the interviews was to discover what coaches do during intermissions and why they do it. A thematic analysis (Braun & Clarke, 2013) of the data revealed specific coaching routines during intermissions that guided the coaches' behaviors, such as how they gathered information and when they addressed their team. In addition, different factors such as the time of season, the score of the game, and the team performance influenced the coaches' intermission strategies and decision-making. While research has shown that coaches' behaviors impact their athletes' performances during competition, there is limited knowledge on these behaviors during intermission. This study revealed both the knowledge and thought processes of experienced coaches during this somewhat overlooked but important time period during competition.

The dynamic influence of relationships in the development of elite individual sport athletes: A timeline approach

Allan, Veronica, Staehli, Julie-Anne, Smith, Haley, Queen's University; Evans, M. Blair, Pennsylvania State University; Cote, Jean, Queen's University

While it is well recognized that relationships with parents, peers, and coaches play an important role in the development of sport expertise, these relationships have largely been studied in isolation (e.g., Keegan, Harwood, Spray, & Lavallee, 2009). Considering that forms and contexts of sport involvement evolve as athletes develop along the pathway to elite sport performance (e.g., Cote, Turnnidge, & Evans, 2014), it is important for researchers to explore the patterns formed in relationships as sport activities and environments change over time. The purpose of this study was to explore the dynamic role of relationships in the context of these other important elements throughout the developmental timelines of elite individual sport athletes. Using qualitative methods informed by grounded theory (i.e., Corbin & Strauss, 2010), initial data collection and analysis involved interviews with ten elite male and female distance runners. Subsequently, six elite male and female mountain bikers were interviewed to contrast themes from both samples. All participants took part in a semi- structured interview protocol, encompassing a novel retrospective timeline approach. Using thematic analysis and the constant comparative method derived from grounded theory, four phases of relationship development were identified: (1) social interactions with the sport world, (2) influential individuals enable discovery of performance potential, (3) deepening relationships and emerging support networks nurture development of sport expertise, and (4) established networks, realization of 'self," and collaborative coaching foster a professional sport career. Important transitions and contextual features were also noted within and between each phase, including differing degrees of access related to each sport. Not only do these findings shed light on the dynamic role of relationships and other contextual factors throughout the developmental trajectory of elite individual sport athletes, but they also demonstrate unique facets of socio-economic privilege and proximity to the sport context.

University athletes' needs for social support during recovery from protracted concussion symptoms

Andre-Morin, Daphnee, Bloom, Gordon A., Caron, Jeffrey G., McGill University

Researchers have estimated that 1.6 to 3.8 million concussions occur each year, with the majority of them occurring in sport (Marshall et al., 2015). While most concussions resolve within 7 to 10 days, 10 to 20% of athletes experience protracted concussion symptoms that can persist from weeks to months to years (McCrory et al., 2013). Although researchers have postulated that athletes may require social support following a concussion, researchers

have yet to specifically investigate their needs for support during protracted symptom recovery. As such, the purpose of this study was to address this gap in the literature by investigating female University athletes' needs for social support while recovering from protracted concussion symptoms. Five Canadian female University athletes participated in face-to-face individual interviews. An Interpretative Phenomenological Analysis (Smith, Flowers, & Larkin, 2009) was used to inductively analyze the interview data. Results revealed that social support was a crucial element of the athletes' recovery. Participants described their network of social support, which included family members, coaches, health professionals, and teammates. Athletes discussed their preferences for social support, such as daily check-ins from coaches and teammates, as well as informational support from medical personnel. Moreover, the participants described what they felt were ineffective forms of social support, including being questioned by teammates about their expected return to play date or being told by teammates that they did not look well. The present findings provide one of the first detailed accounts of university athletes' preferences for social support while dealing with protracted concussion symptoms. Given that sport and exercise psychology professionals regularly interact with injured athletes, the present results may provide them with information that can enhance their applied work with this population.

What is it really like to have a concussion? An autoethnography of a female university athlete's protracted concussion experiences

Andre-Morin, Daphnee, Caron, Jeffrey G., McGill University; Wilkinson, Shawn, Concordia University & McGill University

Sport-related concussions have reached epidemic levels (Carroll & Rosner, 2012). Ten to 20% of concussed athletes experience protracted symptoms (> two weeks), and researchers have suggested that female athletes are at greater risk of suffering protracted symptomatology than males (McCory et al., 2013). Protracted concussion symptoms are often accompanied by a combination of physical and psychological sequelae (Broshek, De Marco, & Freeman, 2014), which can impact athletes' personal and professional lives in a variety of ways (Caron, Bloom, Johnston, & Sabiston, 2013). While researchers have reported the types of protracted symptoms that athletes might experience, researchers have yet to provide a detailed account of how these symptoms impact athletes' day-to-day lives. The purpose of this study was to provide an in-depth account of one female university athlete's lived experiences with concussion symptoms that persisted for 12 months. Autoethnography is a type of qualitative research method that allows actions, thoughts, and feelings to be expressed and analyzed from a personal perspective through storytelling (Ellis, Adams, & Bochner, 2011). The first author of this study suffered a concussion in her first semester of graduate studies while playing university volleyball. She catalogued her day-to-day concussion experiences by taking photographs using her mobile device. These photographs then formed the basis of nine voice-recordings (i.e., audiologs), in which she described what the pictures represented and how the pictures were indicative of her concussion recovery. Transcriptions of the audiologs were then analyzed by all three authors and used to create a narrative account of her experiences. Four main themes emerged: I feel like I'm in prison, Is it all in my head?, What am I doing wrong?, and I can finally see the light. This study offers one of the first detailed accounts of an athlete's experiences with protracted concussion symptoms, and details how the combination of physical and psychological sequelae can impact athletes' day-to-day lives.

Having conflicting feelings: Explicit-implicit evaluation discrepancies as a predictor for exercising intentions

Antoniewicz, Franziska, Brand, Ralf, University of Potsdam

The dual process view distinguishes controlled and automatic processes that result in explicit and implicit affective evaluations. Research from social psychology indicates that not only the two evaluations separately but also the discrepancy between them (i.e. explicit-implicit evaluation discrepancy; EIED) is a variable from which future behavior can be predicted. We argue that the direction of an EIED score (i.e. whether the explicit or the implicit affective evaluation is more positive) and correlations between EIED and higher order cognitions, especially cognitive evaluations (e.g. "exercising is healthy") should be investigated when the consequences of EIED are examined. We tested a moderated mediation model in a study with 130 exercisers and non-exercisers. Implicit affective evaluations of exercising were measured with an Affect Misattribution Procedure before the participants reported their explicit affective and cognitive evaluations of exercising together with their intention to exercise in the next week in a questionnaire. Path analyses indicated good fit between the data and our model. Small EIED

predicted stronger exercise intentions, mediated by cognitive evaluations (higher order cognition), when implicit affective evaluations were more positive than explicit affective evaluations. As both, explicit and implicit evaluations, have been shown to be (independently from each other) alterable in interventions, the examination of EIEDs in correlational and experimental research set-ups is necessary for a better understanding of the cognitive and affective mechanisms which regulate exercise behavior.

Passion, coping and burnout in varsity student-athletes.

Apinis-deshaies, Amelie, Halliwell, Wayne R., Montreal University

Passion is a reason why athletes engage in their sport and invest countless hours to reach high standard performance. Athletes will manifest a harmonious passion (HP) toward their sport when it has been internalized into the self through autonomous forms of regulation. In contrast, when internalization is made through controlled forms of regulation, obsessive passion (OP) emerges. At the moment, little is known about the relation between the type of passion manifested by athletes and other psychological constructs important to their success. Rip et al. (2006) found that injured university dancers manifesting HP made efforts to deal directly with their injury, whereas dancers manifesting OP were ignoring the pain. This result suggests that different types of passion may be associated with the usage of different coping strategies. In addition, in professional work environments, OP has been associated with an increase in the symptoms of burnout experienced by the workers. The main purpose of this study was therefore to investigate whether the type of passion manifested by athletes is related to 1) the coping strategies they use and 2) their symptoms of burnout. Seventy-four student-athletes, 39 females and 35 males (mean age 21.5 SD 2.1), competing in varsity rugby and swimming teams of the Universite de Montreal completed the Passion Scale, the Inventory of Coping Strategies in Sport Competition, and the Athlete Burnout Questionnaire. Our results revealed that athletes used different coping strategies based on the type of passion manifested. More specifically, HP was associated with a greater use of efforts expenditure (M = 4.3 SD 0.62) and thoughts control (M = 2.33 SD 0.49) than OP (M = 4 SD 0.59 and M = 2 " 0.49, respectively). In contrast, OP was associated with the usage of disengagement coping (M = 1.94 SD 0.68) and more exhaustion (M = 3.28 SD 0.79) than HP (M = 1.62 SD 0.67 and M = 2.57 SD 0.88). Our results suggest that obsessive athletes could benefit from developing task-oriented coping strategies to increase their performance and overall sense of well- being.

Long-term modifications to the psycho-affective profile of elite teenage hockey players with a history of concussion

Archambault, William, Lépine, Julien, Moore, Robert D., Barande, Milan, Ellemberg, Dave, Université de Montréal

Concussive injuries are an increasing public health concern; however, the majority of research focuses on neuropsychological outcomes in adults, with less attention given to developing populations and psycho-affective outcomes. Furthermore, symptoms of anxiety and depression are too often neglected when it comes to the return-to-play decision. PURPOSE: To determine the influence of concussive injuries on psycho-affective health in elite adolescent hockey players. Results from forty-nine elite hockey players (28 concussed, 21 non-concussed) from the Québec Midget AAA hockey league (age 14-17) were analyzed in the current study. Athletes completed a psycho-affective assessment consisting of the Depression (BDI) and Anxiety Inventories (BAI) of the Beck Youth Inventory (BYI). Independent t-tests were used to analyze the raw data and t-scores for both the BAI and BDI. Bivariate correlations were carried out to measure the relations between injury variables and metrics of psycho-affective health. Both the raw and t-scores for the BAI were significantly greater in concussed hockey players versus their non-concussed peers (Raw score: mean = 9.50 vs. 6.24; p = .04 / t-score: mean = 47.86 vs. 44.19; p = .03). In addition, analysis revealed a group trend for the BDI raw scores and t-score (Raw score: mean = 5.68 vs. 3.38; p = .09 / t-score: mean = 46.68 vs. 44.10; p = .06). However, bivariate correlations failed to reveal any significant relations between injury variables and metrics of psycho-affective health relationship (ps = .39 for all). Elite level adolescent hockey players who report to be symptom free on concussion checklists and are actively engaged in their sport still exhibit increased depression and anxiety relative to their non-injured teammates.

Just noticeable differences for whole-body vibration transmitted on a road bicycle
Ayachi, Fouaz S., McGill University; Champoux, Yvan, Drouet, Jean-Marc, Universite de Sherbrooke; Guastavino, Catherine, McGill University

Road vibration transmitted while riding a bicycle has been identified as an important source of discomfort. To design more comfortable bicycles by reducing vibration transmitted to the cyclists, it is important to know how much reduction is needed for the improvement to be noticeable. We conducted psychophysical experiment to estimate the JNDL (Just Noticeable Difference in Level) for whole-body vibration transmitted on a road bicycle. Twenty enthusiast cyclists participated in a 2-AFC discrimination task seated on a road bicycle on a road simulator. The system is excited with vertical actuators reproducing a realistic road excitation, with frequency range from 0.5 to 100 Hz and a reference level of LVib = 140 dB (14 m.s-2 rms). Each trial consisted of a 3 s ‘standard" stimulus, followed by a 1 s pause, followed by a 3 s "comparison" stimulus. Participants were asked to indicate which of the two signals had the greater intensity. Seven stimulus pairs were tested with 40 repetitions each. We measured the amount of vibrations transmitted to the cyclist at two points of contact (i.e. hands and buttocks) using instrumented bicycle components (brake hoods and seat post). The JNDL was estimated from individual psychometric curves at around 1 dB. We also express it in terms of acceleration and absorbed power with Weber fractions around 10 %. These thresholds are comparable with those obtained in previous studies on whole-body vibration in other contexts despite methodological differences in terms of experimental set-up and stimuli.—*NSERC (National Science and Engineering Research Council)*

A systematic examination of policies addressing maltreatment in youth hockey in Canada
Banwell, Jenessa M., University of Toronto

With the growing recognition of the occurrence of maltreatment in sport, various sport organizations have developed policies to intensify efforts around safeguarding youth in sport. In Canada, hockey is the third most popular sport with over 20% of youth between the ages of 5 and 14 years participating (Statistics Canada, 2010). However, enrollment trends are decreasing recently (Hockey Canada, 2013) given claims of safety concerns related to violence and injuries (Therien, 2012). Therefore, the purpose of the current study was to systematically examine and review maltreatment policies in youth hockey across Canada, including the policies of Hockey Canada and 11 Provincial Sport Organizations. Policies were reviewed for the accuracy of definitions and examples of various forms of maltreatment in relation to the published literature, and policies were also reviewed for information about complaint and appeal procedures for hockey participants concerned about maltreatment within their organization. The findings reveal inconsistency in definitions of maltreatment, an absence of empirical grounding for the policies, and a lack of explicit follow-up procedures for filing complaints. Additionally, the Provincial bodies appear to rely upon Hockey Canada’s policies as the "gold standard" and yet its policies were lacking in some areas. The findings illustrate the problems that characterize Canada’s fragmented sport structure in which independent, self-regulating sport organizations are left to develop their own policies. We recommend instead that Sport Canada, as part of its mandate to develop national sport policies in Canada, develop and disseminate standardized policies for the prevention of maltreatment in sport.—*SSHRC Partnership Development Grant*

The effects of fatigue on decision making, motivation, and sprint capacity in a soccer interception task.
Barte, Jeroen, Nieuwenhuys, Arne, Geurts, Sabine, Kompier, Michiel, Radboud University

In competitive soccer, match-induced fatigue is a common phenomenon believed to negatively influence performance. However, the impact of fatigue on soccer-specific decision making remains largely unknown and it is unclear whether potential effects may be explained based on motivational factors or reduced performance capacity. The current study aimed to provide initial insight in these matters by testing the effect of fatigue on decision making in a soccer interception task. Using a counterbalanced design, experienced soccer players (N=28) were tested on two separate days. On both days, players performed a pretest and posttest and in between they were either subjected to a soccer match simulation protocol (high fatigue) or watched a soccer match on television (low fatigue). Each test consisted of 4 maximal 15-meter sprints and 15 interception trials, on which players were instructed to either intercept or not intercept passes that were given by a ballshooter at 5 different speeds. Before each interception trial players rated their motivation to intercept the next pass. Dependent variables included self-reported fatigue (RPE),

decisions to intercept (% of trials), failed attempts (% of interceptions), motivation (1-10), and sprint capacity (sec). Preliminary analyses showed that the soccer match simulation protocol successfully induced fatigue ($p<.001$, $\eta2=.884$). Under high fatigue (but not under low fatigue), the percentage of trials on which players decided to intercept tended to decrease from pretest to posttest (from 62.4"18.3% to 56.0"20.9%; $p=.12$, $\eta2=.089$). No effect of fatigue was observed for failed attempts ($p=.27$, $\eta2=.045$). Underlying these effects, fatigue did not lower sprint capacity ($p=.34$, $\eta2=.048$) but did tend to decrease motivation ($p=.07$, $\eta2=.117$). Results indicate that match-induced fatigue may affect soccer-specific decision making in a sense that players are less inclined to intercept opponents' passes. It is suggested that this effect is rather explained by fatigue-induced decreases in motivation than reduced performance capacity.

Exploring the validity of the self-regulated learning self-report scale in a North American sport sample
Bartulovic, Dora, Young, Bradley W., University of Ottawa

Self-regulatory characteristics should be greatly considered to understand how athletes deliberately practice (Baker & Young, 2014) while developing toward sport expertise (Ericsson, 1996). The Self- Regulated Learning-Self Report Scale (SRL-SRS; Toering et al., 2012), a survey validated with European adolescents, examines how individuals actively participate in their own learning. Although used in sport, it is a dispositional measure equally employed in academia (McCardle, 2015). This study aimed to affirm the face and factorial validity of the SRL-SRS as a sport-specific instrument in a North American athletic sample. First, we vetted the 50 SRL-SRS items with nine independent professor-researchers, each versed in self- regulated learning theory as it relates to sport practice. Researchers rated items on criteria for readability, pertinence to specific self- regulatory processes, and whether items were specific to the sport training context. Collated results identified problematic items and recommendations for revision, which we applied to arrive at a sport- refined 48-item inventory. Next, 272 individual-sport athletes (73% male; M age = 22.4; range: 18-35; weekly training = 13.55 hrs/week) ranging from regional to international competitive levels completed the refined survey. Using AMOS, a confirmatory factor analysis (CFA) was conducted on this refined six factor measurement model. Results showed it fell short of criteria for adequate fit, CFI = .842, SRMR = .098, RMSEA = .055, χ"/df = 1.80. Thus, further exploratory factor analyses (direct obliminal) were performed in SPSS to improve our version of the SRL-SRS. Sixteen items were removed on successive analytic iterations, resulting in a six-factor 31 item model. Finally, fit indices of the resultant model were re-examined in AMOS, with results showing good model fit, CFI = .904, SRMR = .078, RMSEA = .052, χ"/df = 1.72. We discuss the merits of having a sport- specific SRL-SRS that also maintains the conceptual integrity of Toering et al.'s six factors, as well as limitations that could be addressed in future.

Youth athletes' perspectives of punishment use in hockey
Battaglia, Anthony, Kerr, Gretchen, University of Toronto

Although there is a substantial body of literature in psychology on the topic of punishment and well-documented negative effects associated with punishment use (see Durrant & Ensom, 2004), there remains a lack of empirical research on the use of punishment in sport. The purpose of this study therefore was to explore athletes' perspectives of punishment in competitive youth hockey. Semi-structured interviews were conducted with 12 (7 male and 5 female) hockey athletes between the ages of 11-13 years. Data were analyzed according to inductive thematic analysis (Braun & Clarke, 2006). Results revealed that punishments reportedly occurred in competitive hockey frequently and were administered by coaches in the forms of benching, yelling, and forced physical conditioning. The athletes' responses were interpreted to suggest that the use of punishment is considered part of the hockey experience and that such strategies are necessary and beneficial for performance enhancement and behaviour modification. Further, these young athletes viewed the use of punishment- related practices as being unique to the sport context and despite recognizing the differences between school and sport environments, they were unable to suggest alternative strategies to the use of punishment in sport. The findings are interpreted to suggest that athletes are socialized to the use of punishment practices in sport at an early age and learn to subject themselves to and accept various questionable practices to achieve desired performance outcomes, thus supporting the notion of the 'sport ethic" (Hughes & Coakley, 1991).

Examining program quality and basic needs support in two physical activity-based in-school mentoring programs

Bean, Corliss, Forneris, Tanya, University of Ottawa

In recent years, researchers have highlighted the importance of delivering high quality sport and physical activity programs that will foster the development of youth. Given the significance of these contexts for youth in North America, it is important to understand features that enhance the quality of programs within this context. One such feature is the support of youth's basic psychological needs, including autonomy, competence, and relatedness. The purpose of this study was to examine program quality and basic needs support across two physical activity-based in-school mentoring programs (one girls'-only, one boys'-only). A mixed-methods approach was used. Program quality was assessed quantitatively from two perspectives: observations conducted by researchers using the Youth Program Quality Assessment and youth self-report using the Youth Program Quality Survey. Perceived needs support was assessed from the youth perspective using the Learning Climate Questionnaire. In addition, researcher field notes were analyzed qualitatively to provide greater depth of understanding of the program context and interactions between leaders and youth. Results revealed a statistically significant difference in observed program quality and basic needs support between the two programs. Moreover, program quality significantly predicted basic needs support within the girls' program, but not in the boys' program. Four themes emerged from the qualitative data that help illuminate processes that occur in programs that support or hinder basic needs with regards to providing a supportive environment, intentional opportunities for skill-building, supported leadership and mentoring opportunities, and planned opportunities for youth choice. Findings from this study outline the importance of supporting basic needs within youth physical activity programs and provide initial evidence that high program quality positively influences basic needs support, while also outlining important strategies that help foster these program characteristics.—*Social Sciences and Humanities Research Council of Canada*

"The easy way is for the weak": A qualitative exploration of social identity and self-presentation as contributors to overuse injury in physical activity

Beasley, Vista L., Eklund, Robert C., Coffee, Peter, University of Stirling

In this study, social identity of recreational activity group members was proposed to have relevance to overuse injury among Appalachian Trail hikers who sought to complete a 2000+ mile mountain trek. It was hypothesized that group members highly valuing group norms, called social identity content (SIC), with high concern for how they are perceived by others (i.e., self-presentational concern) would persist in goal pursuit, despite the pain experienced in the early stages of overuse injury. A mixed methods design was employed with participants (N = 751) who had attempted to hike the Appalachian Trail. Open-ended responses to an online survey were analyzed to augment the quantitative findings. These analyses revealed: (a) time constraints may moderate the positive relationship found between goal-related SIC and overuse injury; (b) desire to maintain proximity with in-group members may affect pace and mileage choices and thus potentially moderate the observed positive relationship between relational SIC and overuse injury; (c) self-presentational concern for appearing competent, and for being aligned with the group's SIC, may be related to overuse injury even though general concern was not found to be related to these injuries. Because excessive effort is associated with overuse injury, participants (n = 332) described their reasons for choosing to hike a higher- or lower-effort trail segment. Generally, high effort appeared to be associated with in-group status. Those who chose the higher-effort route generally endorsed effort as a moral imperative, a SIC which could contribute to overuse injury. Those who took the lower-effort route engaged in defensive self-presentation tactics, which are commonly used in attempts to repair damaged identities. They also engaged in social creativity, endorsing SIC related to intelligence, practicality, self-compassion, and non-conformity, which may reduce overuse injury. The study provided evidence that the social identity approach and mixed methods design are appropriate frameworks for study of overuse injury.

Social identity, self-presentation, and mental toughness are related to overuse injury pain in physical activity

Beasley, Vista L., Eklund, Robert C., Coffee, Peter, University of Stirling

In this study, social identity of recreational activity group members was proposed to have relevance to overuse injury among Appalachian Trail thru-hikers. To retain favorable group status or membership, it was hypothesized

that highly-identified group members would continue pursuing their goal of completing the 2000+ mile mountain trek, despite the pain experienced in the early stages of overuse injury. The group's social identity content (SIC), which includes highly-valued norms such as accomplishing goals and being mentally tough, was expected to support this persistence. High mental toughness was anticipated to be required for persistence despite overuse injury pain. A mixed methods design was employed to test this proposal (quantitative results presented here) with participants (N = 751) who had attempted to hike the Appalachian Trail. Data were obtained using online measures with responses to open-ended questions being used to identify participants (n = 434) who had experienced overuse injury pain. Those participants were differentiated from those without overuse injury pain by mental toughness (medium/large effect sizes), social identification strength, relational SIC and enjoyment SIC (small effect sizes). Mental toughness and goal-related SIC differentiated those who completed the Appalachian Trail despite overuse pain from those with overuse pain who did not complete the hike, with large effect sizes. Because excessive effort is associated with overuse injury, data was also gathered from participants (n = 332) who reported their choice of hiking a higher-effort (82.5%) or lower-effort trail segment (17.5%). Compared to those who chose the higher-effort route, lower effort choice participants used significantly more words (d = .53) to defend their choice, exhibiting defensive self-presentational tactics. They also scored significantly lower on mental toughness and goal-related SIC measures. The study provided evidence that the social identity approach is an appropriate framework for study of overuse injury.

Emotion regulation strategies uniquely alter gaze behavior and goal-directed motor performance

Beatty, Garrett F., Janelle, Christopher M., University of Florida

Emotion regulation (ER) strategies have been postulated to exert distinct influences on performance as a result of the unique task demands associated with concurrently implementing discrete ER strategies while executing motor tasks. We aimed to determine whether and how the allocation of visual attention contributes to motor performance modification when using various ER strategies. Female participants (N = 84) were randomly assigned to Control (no regulation instructions), Cognitive Reappraisal (CR), Attentional Distraction (AD), or Attentional Focus (AF) groups. Participants in each group were instructed to perform the respective ER strategy while viewing highly arousing, unpleasant images (5-8s) until the image scrambled. Upon image scrambling, participants were tasked to produce a ballistic pinch force equaling 10% of their maximal voluntary contraction (MVC) by squeezing a force transducer with their right index finger and thumb. Reaction time (RT), peak rate of force (PRF), and root-mean-square error (RMSE) were calculated to evaluate motor performance. Change scores (change from the mean of the control group) were calculated for each motor performance dependent variable, and operationalized as the Value Over Default Strategy (VODS). Visual gaze was recorded utilizing an ASL Mobile Eye-XG system. Fixations / Second (F/S), Fixation Duration (FD), and Final Fixation Duration (FFD) measures were calculated to assess gaze behavior. As hypothesized, AF participants exhibited fewer F/S, longer FDs, and longer FFDs compared to CR and AD participants (all comparisons: $p < 0.05$). AF participants displayed improved VODS RT scores compared to CR ($p = 0.017$) and AD ($p < 0.001$). AF and CR participants demonstrated improved VODS PRF, VODS RMSE, and VODS Cumulative scores relative to AD participants (all comparisons: $p < 0.05$). Combined, findings indicate the visual gaze characteristics of distinct ER strategies substantially contribute to variation in motor performance.

A pilot study examining the efficacy of a multi-component transformational teaching intervention on children's physical activity behaviors

Beauchamp, Mark R., The University of British Columbia; Barling, Julian, Queens University; Kaulius, Megan, The University of British Columbia; Rhodes, Ryan E., University of Victoria

The overall purpose of this pilot study was to test the efficacy of a multi-component intervention guided by the tenets of transformational leadership theory (Bass & Riggio, 2006) in relation to child physical activity behaviors. The intervention involved a 30-miunute documentary film entitled "Teachers Matter!: Engaging Youth Through Transformational Teaching" (Wong, 2014, Executive Producer) along with a workbook that was targeted to support the uptake of transformational teaching (cf. Beauchamp & Morton, 2011) among elementary school teachers, with specific regard to their promotion of health-enhancing physical activity among students. The current pilot study involved 9 teachers and their Grade 6 (Mage = 11.11years, SD =0.31, N = 108) students (Nintervention = 64; Ncontrol = 44) who were randomly allocated (at the class level) to either an experimental or wait-list control condition. Pre-test measures of physical activity (as assessed by the PAQ-C, Kowalski et al., 1997) were provided

by students in both conditions in February 2015. One week later teachers in the experimental condition were provided with the intervention materials. Eight weeks later student physical activity measures were once again obtained. Qualitative post-test interviews were also conducted with teachers in the intervention condition. The results revealed that after controlling for baseline measures, students in the intervention condition displayed higher levels of physical activity than those in the control condition ($\eta 2p = .04$, $p<.05$). Results of the post-intervention interviews also pointed to the utility of the intervention resources, as well as their potential integration within the context of larger scale teacher training initiatives. Given the potential "reach" (cf. Glasgow et al, 1999) of this intervention, implications for dissemination and knowledge translation will be discussed.

Transferring values or violence? Examining youths' understanding and processes of life skills transfer through Mixed Martial Arts

Beesley, Theresa, Fraser-Thomas, Jessica L., York University

Mixed martial arts (MMA) is a form of combat sport recently legalized in most western countries. Popular media often profiles the positive outcomes of youth MMA participation (Horkay, 2010) with anecdotal sources linking involvement to improved moral, personal and social development (Gauthier, 2009); however, minimal empirical evidence supports these claims. Positive Youth Development (PYD) is an approach that emphasizes "asset building" in youths' development (Lerner et al., 2005). In sport contexts, PYD research has explored life skills development, suggesting skills learned in sport contexts should be transferred into non-sport contexts (Danish et al., 2004); this process is explained through the Model of Coaching Life Skills (Gould & Carson, 2008). Yet, current methodology is limited in its ability to measure transfer. Past studies have used direct questioning which can influence responses by encouraging reflection, and facilitating transfer (Gass, 1985). The purpose of this study was to examine transfer of life skills that youth learn in MMA into general life contexts using a PYD approach. Participants included 13 youth (ages 9-18) involved in MMA programs. Two questioning approaches were used with the aim of addressing past designs limitations. Six youth answered direct questions about transfer through online journal entries over a one-month period, while seven youth answered non-direct questions. Inductive content analysis results indicated the non- direct group experienced transfer less compared to the direct group. Both groups identified transfer for life skills related to attention, self-control, respect and leadership. Both groups also suggested MMA instructors were the primary facilitator of transfer through role modelling and speaking about the connection between MMA and life. Findings highlight that consideration should be given to data collection approaches when studying transfer. Results are timely, as governments (e.g., Province of Ontario) are currently investigating the impact of youths' participation in combat sports.—*SSHRC and Sport Canada*

Social identities and the cognitive, emotional, and behavioural negotiation of body dissatisfaction and appreciation: Physically active women's aging body narratives

Bennett, Erica V., Crocker, Peter R. E., Hurd Clarke, Laura, The University of British Columbia; Kowalski, Kent C., University of Saskatchewan

Older women often experience concomitant body dissatisfaction and appreciation (Tiggemann, 2015). However, how social identities influence the cognitive, emotional, and behavioural negotiation of body dissatisfaction and appreciation in later life is not well understood. The purpose of this study was to qualitatively examine the body-related perceptions and experiences of 21 physically active women aged 65 to 94. Thematic and structural narrative analyses (Riessman, 2008) of two semi-structured interviews with participants (42 interviews) were conducted to examine their stories pertaining to their aging bodies. Social identities such as ethnicity and sexuality (partnership status and sexual orientation) as well as income and education shaped the ways in which women discussed the aging body. Women of Western European descent expressed discontent with their changing bodies, and placed emphasis on physical activity to control appearance. Self-conscious body-related emotions of embarrassment and guilt permeated their narratives. Women of Eastern European, Latina, and Filipina descent discussed body appreciation with pride, and embodied flexible body attitudes that privileged well-being. Women who were divorced, widowed, or never married engaged in physical activity to retain their independence, yet spoke about these endeavours with fear that they would eventually experience decline and disability. However, married (heterosexual) women were active to retain their youthful, feminine appearance, as a means to retain erotic capital (Hakim, 2010). Women higher in educational attainment and income had more access to physical activity participation than low-income

women who faced financial, transportation, and health and safety barriers. Findings highlight the importance of the social and cultural context in understanding of the role that physical activity may play in shaping how older women perceive, experience, and cope with their aging bodies.

Pleased to meet you? The consequences of newcomer integration processes in sport teams

Benson, Alex J., Wilfred Laurier Univrsity; Eys, Mark A., Wilfrid Laurier University

Properly structured group socialization experiences are critical to integrating newcomers into an unfamiliar environment and alleviating the stressors associated with their transition. We examined how athletes' perceptions of socialization tactics at the onset of a season predicted group cohesion and commitment to the coach later in the season, with a specific interest in the unique consequences of socialization tactics among newcomers and veterans. In total, 347 athletes (58% female, 62.5% veterans) from 18 teams (e.g., football, soccer) participated at both time points and were included in the analyses. Parallel multilevel, multivariate regression models were specified for new members and returning members, with random intercepts at the group-level. Serial tactics (i.e., knowledge transfer between veterans and newcomers) positively predicted the four group cohesion dimensions among all athletes (ps < .05). Further, formal role communication tactics (i.e., providing newcomers with functional knowledge pertaining to their role) positively predicted commitment to coach among all athletes (ps < .05). Whereas formal communication tactics positively predicted group integration " task for newcomers (p = .008), structured role progression tactics (i.e., outlining when and how newcomers will progress in their role) positively predicted group integration-task for veterans (p = .003). Differences also emerged in relation to inclusionary social tactics (i.e., opportunities for inclusive social events), which were unrelated to social cohesion for newcomers, but positively predicted social cohesion for veterans (attractions to group - social, p < .001; group integration - social, p = .005). These results reveal the advantages of socializing newcomers through processes that focus on nurturing relationships between newcomers and veterans and clearly situating newcomers in their roles. We discuss organizational socialization theory as an advantageous framework for systematically investigating the consequences of newcomer integration processes in sport teams.—*SSHRC Doctoral Canada Graduate Scholarship, SSHRC Sport Participation Research Initiative*

Attentional suppression during movement execution: Exploring the underlying mechanisms

Bigliassi, Marcelo, Karageorghis, Costas I., Nowicky, Alexander V., Wright, Michael J., Brunel University London; Orgs, Guido, Goldsmiths, University of London

Highly demanding cognitive-motor tasks can be negatively influenced by the presence of auditory stimuli. The human brain attempts to suppress the processing of auditory distraction in order that cognitive-motor tasks can be completed successfully. The present study sought to explore the inhibitory neural systems that activate in response to potential distractors during the execution of movements. Nineteen participants (10 men and 9 women; Mage = 26.4 years, SD = 3.6 years) were administered isometric ankle-dorsiflexion tasks for 10 s at low-intensity. Electroencephalography was used to assess the electrical activity in the brain, and a music excerpt (2.8 s) was used to distract participants. Three experimental conditions were administered: auditory distraction during the execution of movement (auditory distraction; AD), movement execution in the absence of auditory distraction (control; CO), and auditory distraction in the absence of movement (distraction-only; DO). AD was compared to DO in order to identify the mechanisms of attentional suppression that are associated with shifts of attentional focus from internal to external sensory cues. Right parietal regions of the cortex activated in order to suppress the processing of task-irrelevant stimuli during the execution of an isometric motor task. The brain mechanisms that underlie the suppression of potential distractors during the execution of motor tasks were associated with the activity of the frontoparietal network.

A developmentally informed examination of sibling relationships and perceived sport competence in young athletes

Blazo, Jordan A., Louisiana Tech University; Smith, Alan L., Michigan State University; Whiteman, Shawn D., Purdue University

The motivational implications of siblings in youth sport are understudied. This is surprising given the ubiquity of siblings (McHale & Crouter, 1996) and the tendency of siblings to compare each other's treatment and achievements (Whiteman et al., 2011). In the competitive and comparison-laden context of sport, sibling comparisons and relationship qualities may shape perceived competence. Indeed, sibling warmth and sibling comparisons have been shown to predict a younger sibling's perceived sport competence (Blazo et al., 2015). However, these sibling constructs did not predict perceived competence of a paired older sibling. Age of the younger sibling may explain this finding rather than sibling position. Accordingly, we investigated sibling relationship qualities (i.e., warmth and conflict) and sport comparisons in predicting a younger sibling's perceived sport competence across late childhood and early adolescence. We hypothesized (1) greater sibling sport comparisons and warmer sibling relationships to predict greater perceived sport competence, (2) sibling conflict to negatively relate to perceived sport competence, and (3) age to moderate these associations. Sport- engaged youth (N = 207; Mage = 10.5 1.6 years) from local sport leagues completed established measures of the study variables. Hierarchical regression was used to examine main effects and interactions of the age and sibling variables predicting perceived sport competence. Sibling sport comparisons positively predicted perceived sport competence, $b = .19$, $p < .05$. Also, the interaction of sibling warmth and conflict predicted perceived sport competence, $b = .24$, $p < .01$. Specifically, sibling warmth was positively associated with perceived sport competence in the context of higher-conflict sibling relationships. Age did not moderate findings, suggesting that a younger sibling's relationship with an older sibling is salient in sport across late childhood and early adolescence. Collectively, these findings demonstrate the importance of older siblings to sport competence perceptions of young athletes.

Perceptions of sibling relationships, modeling, and shared activities in youth sport

Blazo, Jordan A., Louisiana Tech University; Smith, Alan L., Michigan State University; Whiteman, Shawn D., Purdue University

Youth spend more time with their siblings outside of school hours than any other relational partner (McHale & Crouter, 1996), yet few studies have examined how sibling relationships contribute to their sport experiences. In general, more positive sibling relationships are linked to greater similarities (a potential marker of sibling modeling) and more shared activities between siblings. In contrast, more negative and hostile relationships are associated with greater sibling differences and more individual maladjustment (McHale et al., 2012; Whiteman et al., 2007). The present study extends the sport and developmental literatures by examining the links of youth perceptions of sibling warmth, conflict, modeling, and shared sport activities. We hypothesized higher perceptions of sibling warmth to predict greater sibling modeling and shared sport activities, and sibling conflict to negatively predict sibling modeling and shared sport activities. Also, given that sibling interactions change as youth enter adolescence (Kim et al., 2006) and peers become more prominent developmental agents (Brown & Larson, 2009), we examined whether age moderated these associations. We hypothesized the magnitude of sibling effects would diminish with age. Sport-involved younger siblings (N = 207) ages 8 to 13 years (M = 10.5 1.6) from local sport leagues completed established measures of the study variables. Hierarchical regression analyses were used to examine main effects and interactions of age and relationship qualities predicting sibling modeling and shared sport activities. As expected, sibling warmth positively predicted sibling modeling ($b = .38$, $p < .01$) and shared sport activities ($b = .46$, $p < .01$). Sibling conflict negatively predicted sibling modeling ($b = -.16$, $p < .05$) and shared sport activities ($b = -.23$, $p < .01$). Age did not moderate findings. Together, the findings suggest that the nature of a relationship with an older sibling has meaningful bearing on youth sport experiences.

The influence of self-talk on junior elite tennis players' emotions and behaviours in competition: a multiple case-study

Boudreault, Veronique, Trottier, Christiane, Provencher, Martin, Universite Laval

Although self-talk has been studied as a cognitive technique to enhance athletic performance, little is known about the influence of spontaneous self-talk used by athletes during competition. The purpose of this study was to examine junior elite tennis players' self-talk during an important tournament using a qualitative multiple-case study (Yin, 2014). Six junior elite tennis players aged 15 to 17 years participated in this study. Semi- structured interviews, asking athletes about their self-talk and its influence on their emotions and behaviours, were conducted individually with each athlete immediately after the tournament. Data analysis was performed by QDAminer software using both inductive and deductive approaches. Findings suggest that the tennis players used various types of self-talk such as motivational and instructional self-talk to monitor themselves. In addition, athletes tended to have self-talk in the form of ruminative thoughts and worries when they felt they should have performed better. In conclusion, self-talk seems to have an influence on participants' emotions and behaviours depending on matchs circumstances. The limitations and practical implications of the study will be discussed.

"Actually, I planned to go the gym but then I didn't feel good about it": Explicit-implicit evaluation differences predict habitual exercise volumes.

Brand, Ralf, Antoniewicz, Franziska, Schinke, Michaela, University of Potsdam

The dual process view of human information processing distinguishes controlled (reflective, propositional) from automatic (impulsive, associative) evaluations. Research in exercise psychology showed that controlled as well as automatic evaluations are correlated with exercising behavior. The associative-propositional evaluation model makes specific assumptions about the mutual interplay of the two processes; e.g. that processes of propositional reasoning are generally concerned with the subjective validation of preceding automatic associations (feelings). There is no study so far mirroring this processual dependency. We developed a testing procedure in which automatic evaluations of exercising were tested with a Single-Category Implicit Association Test (SC-IAT) as evaluative default, from which then, as a result of one's controlled evaluations, deviations could be indicated. Data from 58 participants showed that the interaction of the absolute value of an explicit-implicit evaluation difference (EIED) score (i.e. the magnitude of the deviation) and the EIED's location parameter (i.e. whether the two evaluations are rather positive or negative on average) was able to predict self- reported volumes of habitual exercise better than the two independent scores observed for the participants' controlled and automatic evaluations. The smaller and more positive the EIED was, the higher was the exercise volume. We suggest that future research should address the complex interaction between automatic and controlled evaluations and exercise behavior, rather than continuing to illustrate separate bivariate correlations between the three variables.

Developing a parent-child coping intervention for competitive adolescent athletes

Braun, Courtney J., Tamminen, Katherine A., University of Toronto

Despite the identification of coping strategies for young athletes to deal with sport stressors (Hoar, Crocker, Holt, & Tamminen; Tamminen & Holt, 2010) and the importance of parents in helping athletes to cope with stress in sport (Tamminen & Holt, 2012), there has yet to be an effective intervention targeted toward the improvement of adolescent athletes' coping with the integration of their parents. The purpose of this study was to identify preferences of adolescent athletes and their parents for content and delivery of a coping intervention program. A total of eleven focus group interviews (5 athlete focus groups, 6 parent focus groups) were separately conducted with 9 male and 12 female adolescent athletes from five competitive teams (baseball, volleyball, soccer) and 24 of their parents (14 mothers, 10 fathers). Interviews were transcribed verbatim and subjected to inductive content analyses (Patton, 2002). Results revealed commonalities between the preferences of parents and athletes regarding the mode of delivery for an intervention (classroom-based rather than online), and both groups preferred having a separate initial information session for parents and athletes followed by a combined information session for all participants. Parents and athletes both indicated preferences for practical information sessions which included scenarios, videos, and case studies for coping with stress in sport. Preferences for the content of the intervention differed between parents and athletes. Parents expressed the desire for knowledge on specific psychological

constructs including motivation, imagery, self-talk, and empathy, while adolescents preferred that parent information emphasize general support and encouragement. The results indicated that intervention content should include information on improving parent-child communication as well as specific strategies for coping with stress in sport. Findings from this study will be used to inform the development of a theoretically-grounded coping intervention program for parents and athletes.

Effects of cognitive control exertion on task self-efficacy, muscle activation, and muscular endurance performance

Bray, Steven R., Graham, Jeffrey D., Sonne, Michael WL., McMaster University

Prior exertion of cognitive control is linked to performance impairments across a range of muscular and cardiovascular endurance exercise tasks (Bray et al., 2008; Marcora et al., 2009). Current theorizing (psychobiological model; Pageaux, 2014) proposes a combination of psychological and physiological factors account for these effects. The purpose of this study was to investigate psychological and neuromuscular mechanisms that may mediate the effect of cognitive control exertion on performance of a muscular endurance task. Undergraduate participants (N = 50) completed two isometric handgrip endurance trials (50% of maximum contraction) separated by a modified Stroop task (5-minutes duration) comprised of either incongruent (high cognitive control exertion; HCC) or congruent (low cognitive control exertion: LCC) words and colors. Task self-efficacy for the second endurance trial was measured following the Stroop task. Forearm flexor muscle activation (EMG amplitude) was monitored throughout both endurance trials. Compared to the LCC group, the HCC group showed lower task self-efficacy ($p = .001$, $d = 0.98$) prior to performing the second exercise trial. The HCC group also showed greater forearm muscle EMG amplitude at the onset of the second handgrip trial ($p < .001$, $d = 1.08$) and a greater negative change in endurance performance across trials ($p < .001$, $d = 1.14$). Task self-efficacy mediated the condition-performance effect (95% C.I. = 1.62 " 12.95); however, EMG amplitude was not a significant mediator. Of interest, task self-efficacy and EMG amplitude were moderately correlated ($r = -.47$, $p < .001$). These latter findings suggest participants had anticipatory sense of neuromuscular fatigue prior to performing the exercise task that reduced self-efficacy. Overall, results support previous research and provide evidence that cognitive control exertion affects central brain regions or networks leading to psychophysiological processes that can collectively account for performance impairments in muscular endurance tasks.—*McMaster Arts Research Board*

Moving beyond sports: Student-athletes' views of the moving on! Physical activity transition program

Brooks, DeAnne D., Salem College; Reifsteck, Erin J., Bill, Kayla M., Robinson, Kiaya A., Rothberger, Sara M., Gill, Diane L., University of North Carolina Greensboro

Former student-athletes are no more active or healthier than non-athlete college alumni (Reifsteck et al., 2013; Sorenson et al., 2015), and the transition out of competitive sports can negatively impact student-athlete health and well-being (Kerr et al., 2014; Simon & Docherty, 2014). Moving On! is an evidence-based, theory-driven transition program designed to help student-athletes plan for lifetime physical activity after college. The program incorporates tenets of identity theory and self-determination theory (Reifsteck et al., 2016) and includes group discussion activities as well as introductory experiences with varied lifetime physical activities. To assess the potential value, demand, and feasibility of implementing the program on college campuses, senior student-athletes (N=13) were recruited to participate in a pilot study of the Moving On! program and provided feedback on their experience through evaluation ratings and focus group interviews. The evaluation ratings suggested that the participants enjoyed their experience in program, gained important knowledge, and felt more prepared to transition to a physically active lifestyle after college. Focus group interviews, which were recorded, transcribed and coded by a 5-person research team, revealed that participants viewed Moving On! as a valuable, positive experience, anchored by a change in consciousness. They reflected on their identity as an athlete and person in transition, and expanded their understandings of physical activity, viewing it as potentially enjoyable and health-enhancing in their post-college lives. Comments also suggested that participants appreciated the tools/resources provided in the program and, in particular, valued the education related to goal-setting and strategies for integrating physical activity into their future lives. Findings are promising and demonstrate the utility of translating psychological theory into practice to promote

physical activity during the transition out of sport.—*Project funded by an NCAA Innovations in Research and Practice Grant*

Graded increases in cognitive control exertion reveal a threshold effect on subsequent physical performance
Brown, Denver M. Y., Bray, Steven R., McMaster University

Exertion of cognitive control is associated with subsequent impairment of physical performance (Marcora et al., 2009). However, current understanding is limited to effects drawn from gross manipulations used to study groups exposed to either high or low cognitive demands. The purpose of this study was to investigate the effects of graded exposure to cognitive control challenge on subsequent physical performance. University students (N = 82) performed two endurance trials of isometric handgrip exercise (50% of maximum contraction) separated by a cognitive control manipulation (fixed-pace modified Stroop task). Participants were randomized to one of six conditions: 0, 2, 4, 6, 8 or 10 minutes of exposure to the Stroop task. All manipulations were presented in a 10-minute testing window with the cognitive task occupying the full window in the 10-minute condition and the latter 2, 4, 6, or 8 minutes of the manipulation window in the other condition, with a mild-attention "filler" task performed prior to the cognitive manipulation. Regression analysis showed a significant linear increase in ratings of perceived mental effort with increasing dose of the cognitive control task (R2 0.38, F (1, 80) = 48.10, p < .001). ANOVA, F (5, 76) = 2.84, p = 0.021, with post-hoc contrasts revealed similar null carryover effects for the control (0-min), 2-min, and 4-min conditions (M_{CHANGE} = 2.72 +/- 14.88), which were significantly different from those seen in the 6-min, 8-min, and 10-min conditions (MCHANGE = -9.41, SD = 15.49). Graded exposure to cognitive control challenge shows a linear dose- response relationship with perceived mental effort and a non-linear carryover effect on physical endurance. Results support prior demonstration of a threshold for the carryover effect of cognitive control exertion on later cognitive control (van Dellen et. al, 2012), but are the first to show a threshold cross-over effect from cognitive to physical tasks. Results are discussed in light of the Dual Component Theory of Inhibition Regulation (Reynolds & McCrea, 2015).

Utilizing the Team Environment AssessMent (TEAM) to enhance team building in sport
Bruner, Mark W., Nipissing University; Eys, Mark, Wilfrid Laurier University; Carreau, Jeremie M., Wendigo Lake Expeditions, Inc.

Team building (TB) is recognized as one of the most prevalent and promising group development interventions applied within sport (Bruner et al., 2013). Despite this popularity, many coaches lack the information to effectively target the specific group dynamic elements on a team in need of attention. To address this issue, researchers highlighted the need for a pre-intervention TB inventory to allow coaches and practitioners to diagnose the developmental requirements of the team and to create more controlled, targeted, and effective TB interventions (Brawley & Paskevich, 1997). The primary aim of this study was to develop a Team Environment AssessMent (TEAM) to inform TB interventions. A secondary aim was to apply the inventory in a TB intervention. Twenty-three male adolescent athletes (Mage= 17.9 years) from a Major Junior "A" Ontario Hockey League (OHL) team completed questionnaires assessing TB factors and group cohesion (Eys et al., 2009) before and after (immediately after and 1 month follow-up) an outdoor adventure-based TB intervention. The TEAM assessed 11 group factors drawing from Carron and Spink's (1993) TB conceptual framework and the group dynamics literature. Repeated measures ANOVA results revealed increased and sustained perceptions of role acceptance, F (2, 21) = 6.89, p < .01, leadership, F (2, 21) = 6.50, p < .01, and task cohesion, F(2, 20) = 9.98, p < .01. The results provide preliminary empirical support for the efficacy of the TEAM to assess and enhance the delivery of TB interventions in sport.

Understanding the influence of organizational culture on exercise adherence: A social identity perspective
Bruner, Mark W., Nipissing University; Bailey, Brogan, Dalhousie University; Benson, Alex, Wilfrid Laurier University

Why are certain fitness organizations more effective at retaining their members? A critical factor appears to be whether the prevailing organizational culture fosters a strong sense of belongingness to the club (i.e., connectedness) and is perceived to be an inclusive and accepting environment (i.e., atmosphere) (MacIntosh & Doherty, 2010). Previous research suggests that the link between organizational culture and intentions to stay may be partially

explained by the construct of social identity (Ashforth & Mael, 1989; Cole & Bruch, 2006). The purpose of the present study was to examine social identity as the psychological mechanism linking organizational culture to members' intentions to stay with a fitness organization. Given CrossFit's emergence as a popular fitness organization with a clearly discernible culture (Dawson, 2015), CrossFit offers an ideal research context for testing these relationships. Two hundred and ninety four CrossFit members (Mage= 32 years) from clubs around Canada and the United States completed measures assessing organizational culture (atmosphere, connectedness; MacIntosh & Doherty, 2010), social identity (ingroup ties, cognitive centrality, ingroup affect; Cameroon, 2004), and intentions to stay. Two parallel mediation models were tested where each facet of organizational culture (i.e., connectedness, atmosphere) predicted intentions to stay through each dimension of social identity. Mediation results revealed a significant indirect effect of atmosphere to intention to stay through ingroup affect, B = .29, SE = .10, $p < .01$, 95% CI [.10, .51]. There were also significant indirect effects of connectedness to intention to stay through ingroup ties, B = .06, SE = .04, $p < .01$, 95% CI [.00, .16] and ingroup affect, B = .20, SE = .07, $p < .01$, 95% CI [.08, .35]. Findings provide initial support for the salient role of social identity, in particular, ingroup affect (i.e., the feelings toward the group), in understanding the relationship between CrossFit's organizational culture and member adherence.

Event-related potential indices of cognitive function in long-term yoga practitioners

Brush, Christopher J., Olson, Ryan L., Ehmann, Peter J., James-Palmer, Aurora M., Schreier, Colleen D., Alderman, Brandon L., Rutgers University

Emerging evidence suggests that various forms of mindfulness-based physical activity, such as yoga, are related to improvements in physical and mental health. However, research focused on the relationship between yoga practice and cognitive function is limited. A recent meta-analysis indicated a moderate association between yoga practice and cognitive function (Gothe & McAuley, 2015); however, the underlying neurophysiological mechanisms of this holistic mind-body practice remain unknown. The aim of this study was to use behavioral and event-related potential (ERP) measures to investigate the relationship between yoga practice and cognitive function. Participants (N=78; 60 females) included 39 yoga practitioners with 3.8 SD 3.7 years of yoga experience and 39 age- and sex-matched yoga-novice controls. Participants completed a modified flanker task and an attentional blink (AB) paradigm while continuous EEG was recorded. Behavioral performance (reaction time and accuracy) and P3 event-related potential (ERP) responses were analyzed separately for each task. Behavioral findings revealed the expected congruency effects for the flanker task (ps < 0.001) and task condition effects for the AB task ($p < 0.001$), with less accurate responses for short versus long trials. ERP analyses indicated a group by congruency interaction for the flanker task ($p < 0.05$), such that yoga practitioners displayed greater P3 amplitude relative to controls on trials with higher levels of conflict. These findings suggest a relationship between yoga practice and healthy cognition, as reflected by greater attentional resource allocation during stimulus discrimination tasks. No group differences were observed for RT and accuracy, indicating that ERPs may be more sensitive to the positive effects of long- term yoga practice on select attentional and inhibitory processes. Future efficacy trials and mechanistic studies are needed to advance our understanding of the potential for yoga to enhance cognitive function.—*Rutgers Aresty Research Center*

High stakes environments and the psychological toll on referees: Future directions

Buck, Sarah, Martin, Bryon, Chicago State University

There is currently little published research on the relationship between the culturally driven high stakes environment of sport and the psychological toll on referees. Given that sport at many levels has an emphasis on performance and winning, it is not surprising that some athletes endeavor to do whatever it takes in order to win. Since the goal of a team is to win, the referee is seen as an obstruction if it is perceived that fair or accurate calls are not being made. An overview of violence and other transgressions against referees will be couched within the conflict perspective, which suggests that deviance in sport arises from competition amongst various groups and a quest for power. This quest for power may result in unethical actions brought against referees. There are now countless acts of violence committed against referees, including one who was sucker-punched at a youth football game and left with a broken jaw, as well as attacks leading to death, such as during soccer games in Michigan and Utah, and a beheading during a Brazil soccer match. Although there are several factors of why sport violence pervades, such as the media, fan enjoyment, pressure on athletes to be violent, and bracketed morality, wherein athletes have a different set of morals

on the field than they do off, the psychological ramifications on the referee by an environment that fosters a lack of integrity may not be apparent. For instance, FIFA recently paid millions to the Football Association of Ireland (FAI) over a missed handball call against French player Thierry Handy that prevented the FAI from advancing in the World Cup. The referee involved has since quit. Further, when consequences of an attack on a referee (physical or otherwise) are seen as minor, such as a one game suspension, this may result in a fear of failure on the part of the referee, and the sport environment itself may cause high anxiety in the referee if s/he is seen as an impediment toward winning. A series of research questions will be posed in order to further explore the psychological toll on referees.

Cardiovascular disease risk awareness and its association with preventive health behaviours: Evidence from a sample of Canadian workplaces

Burke, Shauna M., School of Health Studies, Western University; Jacobs, Josephine, Rouse, Michael, Tembo, Rodney, Yaquian, Elisa, Ivey Business School, Western University; Sarma, Sisira, Schulich School of Medicine and Dentistry, Western University; Zaric, Greg, Ivey Business School, Western University

The objective of the study was to determine Canadian employees' level of awareness about their cardiovascular disease (CVD) risk factors and the association between CVD risk awareness and self-reported health behaviours. Cross-sectional data were used to compare employees' (n = 320) awareness of CVD risk factors with biometric measures from a workplace screening clinic. The association between risk factor awareness and health behaviours was assessed using logistic regression analyses controlling for sex, age, marital status, socioeconomic status, and company level attributes. Overall, 39.5% of workers did not know at least one of their CVD risk factors. Respondents had the highest level of awareness about their weight status (74.3% of individuals were correct) and the lowest level of awareness about their cholesterol status (52.0% were correct). Logistic regressions indicated that individuals who did not know at least one CVD risk factor were significantly less likely to meet recommended physical activity levels (OR: 0.26, $p < 0.01$) and to consume three daily servings of fruits and vegetables (OR: 0.31, $p < 0.001$), and significantly more likely to report weekly fast food consumption (OR: 3.72, $p < 0.001$). This study highlights a potential lack of awareness about cholesterol levels among a sample of Canadian employees and demonstrates an association between lower CVD awareness and less self- reported engagement in preventive health behaviours.—*Sun Life Financial Inc. and Mitacs*

Adherence to home-based intermittent walking: Factors contributing to successful and unsuccessful self-regulation

Burke, Shaunna, Lancaster, Rosalind, Birch, Karen, Ferguson, Carrie, University of Leeds

Intermittent exercise (IE) improves exercise tolerance and other independent cardiovascular disease (CVD) risk factors in a range of populations. For IE to be effective, adherence to prescribed programs is crucial. The purpose of this study was to explore differences in the underlying contributing factors involved in adherence and non-adherence to a 12 week unsupervised home-based IE walking program. The program consisted of 3 sessions/week and 32 min/session of 60 s to 4min of fast walking interspersed with 60 s to 4 min of walking at a steady recovery pace. Semi-structured interviews were conducted with 18 sedentary and overweight participants (44 +/- 11yr; 31.8 +/- 3.2 kg/m2). Eleven participants (adherers) completed > 80% of the prescribed exercise sessions (mean: 93.7 and seven participants (non-adherers) completed <40% of the prescribed sessions (mean: 21.4). Thematic analysis was used to compare the differences between adherer and non-adherer groups. The main theme highlighting the differences between the two groups was self-regulation. Within this overarching theme, exercise adherence was related to the following subthemes: (a) prioritizing exercise, (b) exercising choice and initiation, (c) enjoyment and interest and, (d) integrating exercise into daily life. Exercise non-adherence was related to: (a) postponing exercise, (b) a lack of agency and initiation, (c) an apathetic attitude and, (d) disrupted routines. These factors provide insight into how people account for their exercise or non-exercise behaviour and are explained in terms of the interrelationships that they have on one another and their subsequent impact on adherence to exercise programs.—*Heart Research UK*

A desire to maintain physical independence: Exploring palliative care patients' views and opinions on physical activity

Burke, Shaunna, Harley, Clare, University of Leeds

Physical activity can help decrease stress and depression while improving levels of pain, fatigue, and physical functioning in patients with progressive, advanced disease. However, currently we know little about whether patients have an interest in participating in physical activity or how to design effective physical activity programs that meet the needs of this population. The purpose of this study was to explore patients' views and opinions on engaging in physical activity in the hospice setting. Patients (n=12) receiving palliative care participated in a semi-structured interview. Data was analyzed using strategies grounded in a framework approach. Patients reported that they were apprehensive of physical activity, spent most of their time sitting, and were deconditioned. Perceived barriers to physical activity included (a) low physical self-efficacy; (b) impaired physical mobility; (b) fatigue; (c) pain; (d) breathlessness; (e) weakness; and (f) poor balance. Patients expressed a keen interest in taking part in physical activity sessions at the hospice and wanted more information and advice on how exercise can be used to promote independence and improve walking ability. Preferences for physical activity engagement involved (a) light-to-moderate effort; (b) small groups; (c) supervised sessions; (d) morning sessions; (e) short duration (5-20min); (f) outdoor setting; (f) incorporation of assisted devices (e.g., walking frame, cane). These findings provide insight into patients' physical activity preferences and needs and improve our understanding of how to design physical activity programs in clinical practice that meet the needs of patients at the end of life.

Decision making behavior of officials: Examining potential biases

Burnett, Adele M., Kinrade, Noel P., Williams, A. Mark., Brunel University

Although the role of officials in sport is multifaceted, it is their decision making that determines the flow of the game, consistency in fair play, and ultimately the outcome of the competition. Officials are required to meet these demands working in a high-pressured environment, making several split second decisions throughout a game. Yet, despite their importance and distinct influence, officials remain a relatively understudied population sample. Previous research has investigated biases on an officials' performance, including position (e.g., Oudejans et al., 2005), home bias (e.g., Buraimo et al., 2010), and crowd noise (e.g., Nevill, et al., 2002). However, other influences such as increased pressure, from officiating close games or in playoff situations, has rarely been investigated. We explore the decision behaviors of netball umpires expressed as the frequency and types of visible decisions. Moreover, we analyzed the potential patterns of decisions, contextual influences, and biases on umpire's decision making behaviors. Match footage (N = 60) taken from the national league in the UK (2014 Season) was analyzed using performance analysis software. Observational analyses of decisions were based on the body language (signals) and vocalisations made by umpires. The data were collated into three categories: umpire decision (e.g. penalty); court location; and potential influences/biases (home advantage, score, competition stage, television, crowd size and time) as determined by a panel of expert umpires. Findings indicated that umpires make 124 decisions a game (2 decisions per minute) and appear to be influenced by time, home bias, and crowd size. Specifically, more decisions were made in the first quarter. More penalties were awarded to home teams and in games with larger crowd sizes, more decisions were awarded against away players. Additionally, findings suggest that several expected biases were not observed including television coverage, stage of competition, and score. Findings have implications for the training and testing of match officials.

What does the Olympic and Paralympic community want from a Games transition preparation program?

Burrows, Emma, McArdle, Siobhain, Dublin City University

Introduction: The Olympic and Paralympic Games have been described as a significantly difficult transition faced by athletes (McCann, 2000). The identification of the Games as a transition has led to the development of interventions to assist and educate athletes in the management of this period in their career (Schinke, Stambulova, Trepanier, & Oghene, 2014; Stambulova, 2010). The International Society of Sport Psychology recommends that the socio-cultural context of a transition should be taken in to consideration when planning an intervention (Stambulova, Alfermann, Statler, C"te, & Cote, 2009). The present study is a needs analysis conducted with the Irish Olympic and Paralympic communities to inform the design of a feasible and acceptable psychoeducation

intervention for the Games transition. Method: Semi-structured qualitative interviews were employed with athletes (N=10), coaches (N=6), and support personnel (N=6) with experience of the Olympic and/or Paralympic Games. Participant's views on the content, structure and implementation of a Games transition psychoeducation intervention were explored. Participants were also asked to respond to questions exploring perceived enablers and barriers to engagement. Interviews were audio recorded and transcribed verbatim. Directed content analysis was applied to the transcripts. Results: The findings revealed 4 priority areas to be addressed in a transition psychoeducation intervention. Participants suggested that to maximise engagement with the intervention it needs to be packaged around performance outcomes, and advocated for by an athlete's governing body, coach, support personnel and other athletes. Conclusions: This study offers insight in to what the Irish Olympic and Paralympic communities want from a transition psychoeducation intervention and how it should be packaged, delivered and advertised to maximise engagement.—*Irish Research Council Enterprise Partnership Scheme EPSPG_2014_26*

An investigation of the generalizability of buoyancy from academics to athletics

Calhoun, Jackie RV., Webster, Elizabeth K., Louisiana State University; Garn, Alex C., University of Newcastle

Objective: To determine the generalizability of academic buoyancy to the domain of sports, and investigate predictors of athletic buoyancy. Method: Students from 14 sport clubs at a large university (N = 286; M age = 19.76, SD = 1.9; 57.7% male) participated in a survey examining athletic and academic buoyancy, as well as reported scores on the five predictors (5Cs): confidence, coordination (preparation), commitment, composure (anxiety), and control. Internal consistency was examined using Cronbach alpha estimates. A correlation matrix and simultaneous multiple linear regression were used to address the relationship between academic and athletic buoyancy and the predictive utility of the 5Cs on athletic buoyancy. A second multiple linear regression was conducted to explore the prediction of academic buoyancy from the sports-oriented 5Cs. Results: All Cronbach alphas were above .70. Athletic and academic buoyancy were moderately correlated ($r = .52$, $p < .001$). A regression model revealed that the 5Cs significantly predicted athletic buoyancy, $F(5,278) = 20.05$, $p < .001$, adj $R2 = .25$. Commitment (beta = .12, $p = .04$) and composure (beta = -.42, $p < .01$) added significantly to the model. Confidence (beta = .12, $p = .059$), coordination (beta = .11, $p = .054$), and control (beta = -.11, $p = .051$) did not add significantly to the model, though only by a small margin. A second regression model revealed that sports-oriented 5Cs also predicted academic buoyancy, $F(5,277) = 10.45$, $p < .01$, adj $R2 = .14$. Confidence (beta = .18, $p < .01$) and composure (beta = -.27, $p < .01$) added significantly to the model. Conclusions: Buoyancy, the ability to handle daily setbacks and challenges, is a relevant concept to athletics and academics. The relation between athletic and academic buoyancy suggests the possibility of a multidimensional buoyancy structure. Competitive sport anxiety appears to undermine both athletic and academic buoyancy, yet predictive patterns varied by buoyancy domain. Findings set the stage for the development of a comprehensive model of multidimensional buoyancy.

The effects of transformational leadership, passion for coaching, coaching efficacy and successful intelligence on passion for players using hierarchical linear modeling.

Caliskan, Gokhan, Gazi University; Ozer, Arif, Hacettepe University; Asci, Hulya, Marmara

Abstract Introduction: U19 league players are candidates could step into the professional soccer life. Considering this aspect, these players may be an investment or capital for soccer clubs. The passion is a strong motivational force towards a considered factor, a player who is kept in the competition world. The study aims to examine passion of sports coaches' and players' axis, two key elements in the context of sport. In this sense, Vallerand et al. (2003) developed a dualistic model of passion, harmonious and obsessive passion is thought to lead to different cognitive and affective. The main purpose of this study was to explore the relationships between coaches' passion, coach-athlete relationship, coaching harmonious and obsessive passion of soccer players. Method: Data for the current study were derived from randomized sampling. The study was administered to players and coaches in thirteen U19 Elite Soccer teams from Turkish super and first league in September 2015. On average, 16 players from each team participated in the study. Each participant completed the Differentiated Transformational Leadership Inventory (Callow et al. 2009), LMX 7 (Leader-Member Exchange) adapted coach- player relationship (Caliskan, 2015), The Coaching Efficacy Scale (CES; Feltz et al., 1999), The Successful Intelligence Questionnaire (Sternberg & Grigorenko, 2002), and The Passion Scale (Vallerand et al. 2003). Hierarchical linear modeling analyses in the present study were performed using HLM 7. Results: The average regression slope between teams is significant

statistically. That the relationships between LMX and the obsessive passion are different statistically among teams. There is high correlation between the interceptor and slope. The other relationships among variables is discussed covered the model. Conclusions: The results of the hierarchical linear modeling (HLM) analyses indicate that strong passionate teams had strong coach-athlete relationship (LMX) and obsessive relationships.

The controlling interpersonal style, types of motivation, self-esteem and burnout in Mexican athletes

Cantu-Berrueto, Abril, Lopez-Walle, Jeanette M., Universidad Autonoma De Nuevo Leon; Castillo, Isabel, Universitat de Valencia; Tristan, Jose L., Universidad Autonoma De Nuevo Leon; Alvarez, Octavio, Balaguer, Isabel, Universitat De Valencia

Self-determination theory (Deci & Ryan, 1985) postulates that coach behaviors have important consequences on motivation and that athlete whose motivation is more or less self-determined tend to report positive or negative outcomes. The purpose of the present study was to examine gender differences in the perception of a controlling interpersonal style created by the coach, types of motivation, self-esteem and burnout in university athletes. Participated 2327 Mexican university athletes (M = 21.26, SD = 1.99), 1,377 males and 950 females, and fulfilled the Spanish version of the Controlling Coach Behaviors Scale (CCBS), the Sport Motivation Scale (SMS), the Self-Description Questionnaire (SDQ-III) and the Questionnaire Burnout Athlete (ABQ). The results of MANOVA showed significant differences between gender in the study variables. We conducted separate moderated hierarchical analyses by gender, predicting self-esteem and burnout from controlling style and types of motivation (two for each gender). The results showed that in males, self-esteem was predicted in a negative manner by controlling style (beta = -.22); in females, self- esteem was negatively predicted by controlling style (beta = -.17) and no motivation (beta = -.10) and positively predicted by autonomous motivation (beta = .10). With regard to burnout, in males was positively predicted by controlling style (beta = .56) and no motivation (beta = .30) and negatively predicted by autonomous motivation (beta = -.12); in females, burnout was positively predicted by controlling style (beta = .43) and no motivation (beta = .38) and negatively predicted by autonomous motivation (beta = -.15). The present study with Mexican athletes is in line with previous research and emphasizes the importance of the interpersonal style created by the coach as a key determinant of athlete's motivation and in turn of their well-being and ill-being. Although there are significant differences between genders in the study variables, the relationship that the theory postulates are very similar in both genders.

A prospective investigation of motivational regulations as mediators in the relationship between body-related shame, guilt and physical activity in breast cancer survivors

Castonguay, Andree L., Concordia University; Pila, Eva, University of Toronto; Wrosch, Carsten, Concordia University; Sabiston, Catherine M., University of Toronto

Background: This study tested body-related shame and guilt as predictors of breast cancer survivors' (BCS) moderate-to-vigorous physical activity (MVPA) over 6 months. Motivational regulations were examined as mediators of this association. Methods: Self-reports of body-related shame and guilt, motivational regulations, and MVPA were measured among 149 female BCS at baseline (Time 1). MVPA was assessed a second time 6-months later (Time 2). Results: In the multiple mediation models, body-related shame predicted low levels of MVPA over 6 months (β 1 = -.35, β Time 2 = -.54), as well as external (β Time 1 = .17, β Time 2 = .19), introjected (β Time 1 = -.47, β Time 2 = -.54), and self-determined (β Time 1 = -.30, β Time 2 = -.30) motivational regulations. Guilt predicted high levels of MVPA (β Time 1 = .63) and introjected (β Time 1 = .94, β Time 2 = .94) and self-determined (β Time 1 = .17, β Time 2 = .19) motivational regulations. There were indirect effects between shame (point estimateTime 1 = -.17, 95% BCa CI = -0.35, -0.04), guilt (point estimateTime 1 = .21, 95% BCa CI = 0.06, 0.41; point estimateTime 2 = .09, 95% BCa CI = 0.00, 0.24) and MVPA via self-determined motivation. Only body-related shame was a significant predictor of changes in MVPA (β = -.41). Conclusions: Based on these results, the specific emotions of shame and guilt contextualized to the body differentially predict BCS' health motivations and behavior over time. Integrating body-related self-conscious emotion programs into clinical practice may be warranted.

Understanding the overuse injury process: creative nonfictions of pain in gymnastics
Cavallerio, Francesca, Wadey, Ross, St Mary's University, Twickenham; Wagstaff, Christopher, University of Portsmouth

The aim of this study was to gain an in-depth understanding of the increasingly prevalent occurrence of overuse injuries in sport from a psychosocial perspective. In order to effectively portray the sport culture and athletes' experiences, ethnographic inquiry was considered the most appropriate methodology. For 12-months the first author acted as a participant-observer in an elite rhythmic gymnastics club, with 28 participants: 16 gymnasts, 3 coaches, 1 manager, 7 parents, and 1 physiotherapist. Data collection methods included the use of fieldwork observations, field notes, formal interviews, informal conversations, focus groups, a research log, and a reflective journal. Following data transcription thematic analysis was conducted, the results of which centered around four main themes: (a) time pressure, (b) impression management, (c) poor communication between coach and athletes, and (d) pain normalization behaviors. Given the salience of extending individual's awareness of the growing prevalence of overuse injuries the findings were presented using ethnographic creative nonfiction. Such approaches allow researchers to illustrate the complexity of rich phenomena while also reaching multiple audiences, making scientific research available to stakeholders in the sport environment (e.g., coaches, athletes, parents, managers). Two stories were created portraying the same training session through the eyes of a gymnast and her coach. By interpreting the findings using Foucault's theory of social control and disciplinary power, and Bourdieu's habitus and symbolic capital, the study illuminates the intersection between the psychology and sociology of sport, introducing novel concepts hitherto underrepresented in the sport psychology literature on overuse injuries. Moreover, by increasing awareness on this issue, these findings might facilitate changes in beliefs and behaviors among stakeholders in sport organizations within gymnastics environments.

Physical Activity Intervention for Non-active Adults from Economically Challenged Families: "Will for Movement and Movement for Will"
Cecic Erpic, Sasa, University of Ljubljana

Due to the recent socio-economic crisis, the poverty rate in Slovenia is increasing. Not only high unemployment rate but also working in low-paid jobs often lead to poverty and social exclusion. In economically challenged families, where adults are trying to provide resources for family members their everyday life often revolve around negative and unpleasant experiences. Low socioeconomic status and limited resources often lead to unhealthy and non-active lifestyles. The aim of the project was to create a physical activity intervention for non-active adults to promote an active lifestyle and through that the improvement of quality of life. "Will for Movement and Movement for Will", a 15-weeks long physical activity intervention was developed for the purposes of the project. Besides increasing physical functioning, strong emphasis in the intervention was placed on the psychological aspects, related to motivation and determinants of behavior change. 20 non- active adults (aged from 18 to 73) started with the program. Semi-structured interviews covering their life story, physical activity and health related behaviors, together with a series of motor tests, were conducted at the beginning and after the end of the program. The intervention, its process and outcomes (psychological and motor) will be presented and discussed.—*Norwegian Financial Mechanism*

Student-athletes' entering the university: Complex transitional times in sport and education
Cecic Erpic, Sasa, University of Ljubljana

Although the within-career transition between developmental and mastery stage is one of important periods in sport career development (Stambulova et al., 2009), relatively little is known about the experiences of athletes' adaptation to changes during this critical time. This transition coincides with transition to the university, which is one of the major life transitions in young adulthood. In order to succeed in education and in sport, athletes have to find an effective balance between restrictions and demands of both systems. According to Holistic athletic career model (Wylleman & Lavallee, 2004), student-athletes (SA) have to adapt to the respective changes at the athletic, psychological, psychosocial and educational level. Using a cross- sectional design, 60 high-level athletes, students of 1st year university study were asked to complete Student- athletes' Transition to University-II (SATU-II; Cecić Erpič, 2014) questionnaire. Descriptive analysis indicated that SA experience changes at all four levels. The

qualitative analysis gave an in-depth insight into the transition from junior to senior level and the demands of dual careers. Results showed that during transition to the university SA experience complex changes. Transitions occurring in the athletic career and those occurring in other domains of the athlete's life are concurrent and reciprocally interact.

Acute moderate exercise, but not serum BDNF, facilitates cognition: A time course of ERP study

Chang, Yu-Kai, National Taiwan Sport University; Chi, Lin, Ta Hwa University of Technology; Wang, Chun-Chih, National Taiwan Sport University; Chu, Chien-Heng, National Taiwan Sport University

The present study was conducted in order to determine whether acute exercise enhances multiple cognitive functions in a general way, or improves selectively larger aspects of executive functions. This study extends the previous research in this area by investigating potential neuroelectric and neurobiological mechanisms simultaneously, in terms of acute exercise effects on cognition, by testing the comprehensive time course of stimulus-locked ERP components and serum BDNF levels. 25 participants were voluntarily recruited and were required to visit the laboratory twice individually, for treatment sessions (i.e., an acute exercise and a reading control session). During the exercise session, participants pedaled on the cycle ergometer under an acute exercise protocol for 30 minutes that consisted of 5 minutes of warm-up, 20 minutes of steady-state exercise at 60% to 70% of heart rate reserve, and 5 minutes of cool-down. In the reading control session, test participants were asked to read physical activity related books for the 30 minutes. Participants had their blood samples drawn immediately (i.e., within 2 min) and were then required to perform a Stroop Test while outfitted with an electrode cap in order to record their EEGs (i.e., within additional 15 min), following the cessation of each treatment session. The results indicated that the acute exercise facilitated response times on both the Stroop congruent and incongruent conditions, but had a larger magnitude of increase on the Stroop incongruent condition. Additionally, acute exercise induced larger P3 and smaller N450 amplitudes, as well as a decreased N450 latency, but did not influence N1, P1, N2, and serum BDNF levels. These findings suggest that acute exercise improves cognition both generally and in selective ways. This facilitation may be related to acute exercise induced attentional resource allocation and conflicted detection processes, as indicated by late and endogenous components, but not sensory processes, as was revealed by the early ERP component and the peripheral BDNF.

Understanding physical activity behaviour in adults with spinal cord injury: A longitudinal test of the health action process approach

Chemtob, Keryn, McGill University; Arbour-Nicitopoulos, Kelly P., University of Toronto; Lamontagne, Marie-Eve, Universite Laval; Martin Ginis, Kathleen M., McMaster University; Routhier, Francois, Universite Laval; Latimer-Cheung, Amy E., Queen's University; Sweet, Shane N., McGill University

Background and Purpose: Physical inactivity is a concern among adults with spinal cord injury (SCI). Theories can help understand the important psychosocial factors for increasing physical activity in this population. The goal of the study was to test the Health Action Process Approach (HAPA) longitudinally among adults with SCI. Methods: 77 adults with SCI (mean age M=47.95 (SD=10.41), 79% male, 17.5 (SD=12.09) years since SCI, 55% with tetraplegia) were recruited to a randomized control trial. They answered a questionnaire at baseline, one day, one week and one month after exposure to a physical activity resource. Five constructs from the HAPA model (task self-efficacy, outcome expectations, intentions, action planning, barrier self-efficacy) and moderate-to-vigorous physical activity (MVPA) were assessed. MVPA was dichotomized: less than 20 minutes or 20+ minutes. The two groups were collapsed for a secondary data analysis using path modeling. Results: Model fit was adequate (WRMR=0.76). Barrier self-efficacy was removed from the model due to suppression effects. Task self-efficacy (B=.56, b=0.51, 95%CI=.35, .65) and outcome expectations at baseline (B=.28, b=0.40, 95%CI=.19, .65) were related to intentions at one day. Baseline task self-efficacy (B=.44, b=0.41, 95%CI=.14, .67) and intentions at one day (B=.41, b=0.43, 95%CI=.16, .72) predicted action planning at one week. Action planning at one week (b=0.73, 95%CI=.41, 1.18) was related to MVPA behaviour at one month. Intentions at one day mediated both the relationship between baseline task self-efficacy (b=0.22, 95%CI=.09, .40) and outcome expectations (b=0.17, 95%CI=.06, .39) with action planning at one week. Action planning at one week mediated the relationship between intentions at one day and MVPA at one month (b=0.31, 95%CI=.09, .50). Conclusions: The results demonstrate the HAPA model holds for

adults with SCI when tested in a longitudinal model. HAPA is a viable framework to understand MVPA behaviour among adults with SCI and thus would be appropriate for use in physical activity interventions.

The dose-response relationship between the duration and switching aspects of executive function in middle-old-aged adults: A preliminary study

Chen, Feng-Tzu., Hsieh, Yu-Chen., Liu, Jen-Hao, Chang, Yu-Kai, National Taiwan Sport University

A recent study examined the relationship between exercise duration and higher-order cognitive aspects, such as executive function, and found that individuals engaging in acute exercise for 20 minutes had better executive function performance than those undergoing 10 minutes, 45 minutes and control treatments. However, majority of those studies mainly focused on the inhibition aspects of executive function, yet the dose-response relationship between exercise duration and shifting aspects is unknown. Moreover, past research has always focused on the younger adult population and few studies were focused on the middle-old-aged population. Therefore, the present study was completed in order to evaluate the dose- response relationship between acute exercise duration and executive function, particularly as related to switching aspects among a middle-old-aged population. Fifteen healthy adults, aged 55-65 years old, were recruited. All participants were randomized into a reading control treatment and three exercise treatments. Reading sports or exercise magazine was used as the control treatment, and cycling on an ergometer was the exercise treatments, which consisted of a 5 minute warm up, a 5 minute cool down, and formal exercise performed at 65% heart rate reserve (HRR) of intensity for 10, 20, and 45 minutes. A Task switching task was examined within five minutes following after each of the arranged treatments. The results revealed that acute moderate exercise for 20 minutes resulted in significantly shorter reaction times for both global and local switches, as compared with the 10 minute and control treatments. Additionally, no differences were found between the 20 minute and the 45 minute exercise, with that acute exercise for 45 minutes also showed significantly greater reaction times as compared with those in the control treatment. These findings suggest that acute exercises of moderate intensity for 20 minutes displayed a higher degree of switching enhancement, whereas a short-term duration of acute exercise and the reading treatment had negligible benefits.

The dose-response relationship between duration and executive function in middle-late-aged adults: A preliminary study

Hsieh, Yu-Chen, Chen, Feng-Tzu, Chang, Yu-Kai, National Taiwan Sport University

Previous studies demonstrated an inverted-U relationship between exercise intensity and cognitive function. A recent study further examined the relationship between exercise duration and higher-order cognitive aspects, such as executive function, and found that individuals engaging in acute exercise for 20 minutes had better performance than those undergoing other treatments. However, majority of those studies mainly focused on the inhibition aspects of executive function, yet the dose- response relationship between exercise duration and shifting aspects is unknown. Moreover, few studies were focused on the middle-late-aged population. Therefore, the present study was completed in order to evaluate the dose-response relationship between acute exercise duration and executive function, particularly as related to switching aspects among a middle-late-aged population. Fifteen healthy adults, aged 55-65 years old, were recruited. All participants were randomized into a reading control treatment and three exercise treatments. Reading sports or exercise magazine was used as the control treatment, and cycling on an ergometer was the exercise treatments, which consisted of a 5 minute warm up, a 5 minute cool down, and formal exercise performed at 65% heart rate reserve (HRR) of intensity for 10, 20, and 45 minutes. A Task switching task was examined within five minutes following after each of the arranged treatments. The results revealed that acute moderate exercise for 20 minutes resulted in significantly shorter reaction times for both global and local switches, as compared with the 10 minute and control treatments. Additionally, no differences were found between the 20 minute and the 45 minute exercise, with that acute exercise for 45 minutes also showed significantly greater reaction times as compared with those in the control treatment. These findings suggest that acute exercises of moderate intensity for 20 minutes displayed a higher degree of switching enhancement, whereas a short-term duration of acute exercise and the reading

Influences of physical and psychological factors on physical activity for older adults attending the community service centers in Taiwan

Chen, Shuya, Zheng, Yi-Ru, Lan, Yu-Ching, Chang, Wen-Dien, China Medical University; Chou, Chih-Ping, University of Southern California

"Active aging" and "aging in place" are both important concepts for promoting older adults' health. In the last decade, the Taiwanese government launched the person- centered community service centers for the older adults. Unlike community care centers, the community service centers emphasize physical activity to prevent older adults from becoming a person who needs to be cared. However, a previous study found that the older adults who regularly attend the community service centers in Taiwan did not increase their physical activity outside the centers. Therefore, this study aimed to explore the critical factors for physical activity in this particular population in order to provide suggestions for appropriate community health strategies. The older adults aged over 65 years old were invited to complete the questionnaires including physical health questions (e.g., activity of daily living, ADL; instrumental activity of daily living, IADL), psychological health questions (e.g., severity of depressive symptoms, feeling about aging), and the international physical activity questionnaires. There were 98 participants completed the questionnaires (age: 76.9"7.5 y/o). The average amount of physical activity was 1.0 hour/day while the sitting time was 4.88 hour/day. Other than the physical activity, we found that the daily sitting time was significantly correlated with the level of difficulties to perform ADL ($p<0.05$) and IADL ($p<0.05$), the severity of depressive symptoms ($p<0.05$), and the feeling about aging ($p<0.05$). This is the first study to explore the physical and psychological factors influencing physical activity for older adults attending the community service centers in Taiwan. The results showed that the amount of physical activity for older adults is not as much as expected. When promoting community health strategies, one should take both physical and psychological factors into account.—*China Medical University, Taiwan (CMU103-S-40)*

A teacher-focused intervention to both increase PE students' engagement and to decrease PE students' disengagement

Cheon, Sung Hyeon, Kangwon National University; Reeve, Johnmarshall, Song, Young Gwan, Korea University

The purpose of the present study was to implement a teacher-focused intervention program to help PE teachers learn how to both increase their students' classroom engagement and to decrease their disengagement. We used a self-determination theory framework to design and implement an autonomy-supportive intervention program (ASIP) to help PE teachers become significantly more autonomy supportive and significantly less controlling toward students during instruction. We predicted that (1) if teachers could learn how to become more autonomy supportive, then they would provide instruction in more need-satisfying ways that would in turn longitudinally increase their students' engagement and (2) if teachers could learn how to become less controlling, then they would provide instruction in less need-frustrating ways that would in turn longitudinally decrease their students' disengagement. We randomly assigned 20 PE teachers (and their 1,477 students) to the experimental (intervention) group and 17 PE teachers (and their 1,191 students) to the control (no intervention) group, and students' completed measures of perceived motivating style, need satisfaction-frustration, and engagement-disengagement at the beginning, middle, and end of a 17-week semester. At mid-semester, trained raters also scored teachers' autonomy-supportive and controlling instructional strategies (manipulation check) and students' classroom engagement and disengagement (outcome). Multi-level structural equation modeling analyses showed that students of teachers in the experimental group reported longitudinal gains in their mid-semester need satisfaction that in turn explained their longitudinal gains in end-of-semester engagement, and these same students further reported longitudinal decreases in their mid-semester need frustration that in turn explained longitudinal decreases in their end-of-semester disengagement. Raters scored students of teachers in the experimental group as significantly more engagement and as significantly less disengagement than they scored students of teachers in the control.

Experimental test of teacher intervention to increase elementary-grade PE students' need satisfaction and classroom engagement

Cheon, Sung Hyeon, Kangwon National University; Reeve, Johnmarshall, Korea University; Song, Yong Gwan, Korea University

Classroom engagement is the extent to which students are actively involved in learning activities. Based on self-determination theory (SDT), we hypothesized that increases in engagement occur as students experience gains in their psychological need satisfaction (autonomy, competence, relatedness) and declines in their psychological need frustration and, further, that these increases in need satisfaction and decreases in need frustration occur when teachers are more autonomy supportive. To test this model, we conducted an experimental study in which teachers were randomly assigned into either an experimental group to receive a 4-part 11-hour workshop in how to be more autonomy supportive and less controlling or a control group in which teachers taught in their typical way. Their students completed measures perceived autonomy support, perceived teacher control, need satisfaction, need frustration, and engagement (using 1-7 scales) at the beginning (T1), middle (T2), and end (T3) of a semester. ANCOVA-based repeated measures analyses (controlling for gender) tested for the condition (experimental vs. control) x time (3 time assessments) interaction effect. By T3, students of teachers in the experimental group (vs. those in the control group) perceived more autonomy support (Ms, 5.10, 5.76, 5.70vs. 4.99, 5.09, 5.34; F(2, 116) = 5.37, p< .01, eta2= .09), less teacher control (Ms, 2.42, 1.57, 1.67vs. 2.38, 2.21, 2.36; F(2, 116) = 7.04, p< .01, eta2= .11), greater need satisfaction (Ms, 2.42, 1.57, 1.67vs. 2.38, 2.21, 2.36; F(2, 116) = 7.04, p< .01, eta2= .11), lesser need frustration (Ms, 2.42, 1.57, 1.67vs. 2.38, 2.21, 2.36; F(2, 116) = 7.04, p< .01, eta2= .11), and greater classroom engagement (Ms, 5.17, 5.78, 5.67vs. 5.56, 5.56, 5.56; F(2, 116) = 4.51, p< .01, eta2= .07). We conclude that a SDT-based intervention helps teachers learn the instructional strategies they need to increase students' need satisfaction and to decrease students' need frustration so to motivationally fuel elementary-grade students' classroom engagement during PE lessons.

The association between cardiovascular fitness and inhibitory function in the elderly: An event-related desynchronization study

Chu, Chien-Heng, Wu, Chih-Han, Wang, Chun-Chih, Chang, Yu-Kai, National Taiwan Sport University

Prior research using electroencephalogram (EEG) techniques has reported positive impacts of higher cardiovascular fitness (CF) on the executive function (EF). There is little knowledge, yet, on the influence of CF on EF based on employing the event-related desynchronization (ERD) in an elderly population. The aim of the current study was to explore the influence of CF on the inhibitory aspect of EF, by using the alpha band ERD/ERS to examine participants' neural activities during a computerized version of the Stroop Color-Word task (SCWT). Participants were assigned into either a high-fit group (n = 20, 56 ± 0.2 years) or a low-fit group (n = 20, 54 ± 0.6 years), with each group then being instructed to perform the SCWT with a concomitant EEG recording. Two bands of event-related EEG activities, lower alpha (8-10 Hz) and upper alpha (11-13 Hz) bands, were computed and the percent change of ERDs (ERD%) at 3 different time epochs (T1: 0-250 ms, T2: 251-500 ms, T3: 501-750 ms post-stimulus onset) were calculated. Results revealed the potential linkage between cognitive behavioral performances and CF levels; that is, the higher the CF levels of the individuals, the better the cognitive performances they evidenced, regardless of the SCWT conditions. Findings also revealed an interaction of CF levels with the alpha ERD% values, in which greater positive lower alpha ERD% on high fitness in T1 was observed in the high-fit group. Compared to the low-fit group, the high-fit group also demonstrated less positive lower alpha ERD% values on the SCWT control condition and greater positive lower alpha ERD% on the SCWT incongruent condition in T3. Considering the larger lower alpha ERD%, along with the better behavioral performance of the individuals in the high-fit group, the current study demonstrated that there was an association between the ERD% values and the CF levels of the elderly, and that increased CF could effectively enhance the performance of a SCWT by enabling greater attentional resource allocation during the task performance.

Testing the effects of a short duration self-talk intervention on performance

Clesi, Christian D., University of Alabama Birmingham; Rector, Richard V., Birmingham-Southern College

This study examined the effects of short duration self-talk interventions and learning preference on performance in a novel dart-throwing task. Previous research has shown the effectiveness of cognitive interventions, including self-talk, for athletic performance. However, these studies have implemented long-term cognitive interventions that often span several months and multiple training sessions. This research attempted to replicate these findings using a short-duration intervention, which lasted for only two minutes and involved no training. Researchers in this study created and expanded upon existing self-talk statements and modified them to be dart specific. 60 undergraduate students, aged 18-22, were classified as visual or verbal processors, using the Style of Processing Scale, and placed into a positive or negative self-talk condition. Each participant was given 15 practice throws to familiarize themselves with the task. They then read 15 positive or negative statements and were asked to throw a dart and hit a specific section of a dartboard. For scoring purposes, hitting the targeted area yielded a score of 0. Darts that landed outside of the scoring triangle received a score equal to their distance from the closest point of the targeted area, measured in centimeters. After reading the statements, each participant was instructed to repeat aloud one self-talk statement of their choosing before each throw for the 15 scored trials. Our results show that an interaction between self-talk and learning preference exists, $F(1, 56) = 4.42$, $p = .040$. As predicted, verbal and visual learners performed better using positive self-talk and verbal learners did significantly worse than visual learners when subjected to negative self-talk. Self-talk explained a significant proportion of variance in performance on the dart-throwing task, $R2 = .215$. These findings indicate that self-talk may have a more immediate effect than previously thought and should be used to enhance athletic training and competition.

Effects of two intensities of exercise on memory, concentration, planning, and reasoning.

Codish, Kristen A., Becker, Kevin A., Biggerstaff, Kyle D., Texas Woman's University

Active workstations (e.g., desk cycles) have recently gained popularity as a means of reducing sedentary behavior in schools. In addition to physical benefits, teachers who have adopted active classrooms anecdotally report cognitive benefits such as students being more focused during instruction. In contrast, empirical work suggests that concurrent exercise has a negative effect on cognition (Lambourne & Tomporowski, 2010). The purpose of this study was to compare the effects of no exercise (CON), low-intensity exercise (LOW), and moderate- intensity exercise (MOD) on a series of cognitive measures. Young, healthy participants (n=48) were randomly assigned to either CON (sedentary), LOW (25-30% HRR), or MOD (50-55% HRR) groups. Those assigned to LOW and MOD exercised with a DeskCycle to achieve desired HR while those in CON sat passively at the Deskcycle. Four Cambridge Brain Sciences Inc. computerized tests were completed to assess planning, concentration, short-term memory, and reasoning while exercising. A self-paced word pair recall test was also administered during the exercise bout, and long-term recall of the word pairs was assessed 24 hours later. Separate one-way ANOVAs were conducted on each cognition test. A 3 (group) x 2 (test) RM ANCOVA with the amount of time spent during each test as covariates was used to assess immediate and delayed recall of word pairs. Groups did not differ in planning, concentration, short-term memory, or reasoning scores (p's > .05). In both immediate and delayed memory tests, MOD recalled fewer words than CON when controlling for test time ($p=.049$), and LOW was not different from either group ($p> .05$). In the present study, exercise did not show any effect on planning, concentration, reasoning, or short-term memory. While previous research shows long- term memory is improved by exercise before or after learning (Roig, et al., 2013), moderate-intensity exercise that occurs during learning seems to impair long-term memory recall.

Self-concept clarity of transitioning athletes

Cologgi, Kimberly A., Florida State University; Chow, Graig, Florida State University

The purpose of the study was to examine relationships among athletic identity, reason for retirement, self-concept clarity, and loneliness during the transition process out of competitive athletics. Participants were former high school athletes ($N = 65$) no more than 12 months removed from their last competitive event ($M = 8.52$ months, $SD = 3.2$). Self-concept clarity and loneliness were chosen as outcome variables due to the highly social nature of sport, and known literature supporting role exits effects on overall self-concept (Light and Visser, 2013). Results showed that athletic identity significantly and negatively predicted the self-concept clarity of transitioning athletes. Additionally,

athletes retiring for voluntary reasons showed higher self- concept clarity during the transition phase, as compared to athletes involuntarily ending their sporting careers. Self-concept clarity moderated the relationship between athletic identity and loneliness. Understanding the factors that contribute to an athlete's self-concept clarity and loneliness during the transition process allows practitioners to take a proactive approach by preventing some of the negative consequences associated with these variables including low self-esteem, neuroticism, negative affect, depression, and anxiety (Campbell, 1996).

The role of teacher specialization, age, and gender on the physical literacy of Northeastern Ontario elementary students

Confesor, Valaine, Law, Barbi, Bruner, Brenda, Nipissing University

Only 21% of elementary schools in Northern Ontario report having a physical and health education specialist; yet specialists tend to deliver more effective programs (People for Education, 2015), create more positive effects on physical activity, fitness/skills and better health outcomes for students (McKenzie & Lounsbery, 2009). The purpose of this study was to examine physical literacy scores of students between ages 8-12 who are taught by a PE specialist vs. a non-specialist. A secondary purpose was to explore the influence of age and gender. Children (n=337; M=155, F182; Mage=9.81, SD=1.19) completed the Canadian Assessment of Physical Literacy (CAPL; HALO, 2014), a standardized protocol consisting of fitness tests and a questionnaire assessing motivation/confidence and knowledge/understanding. A 2(Teacher) x 2(Gender) MANOVA was conducted separately for younger (ages 8-9) and older (ages 10-12) groups. In the younger group, there were main effects for teacher ($F(9,112)=8.26$, $p<.001$, $\eta2=.399$) and gender ($F(9,112)=3.98$, $p<.001$, $\eta2=.242$. Univariate tests revealed significant effects of teachers on PACER laps, plank time, obstacle course score and physical competence score (ps<.05, $\eta2=.106$-.257), with those who had a PE specialist scoring higher than those with a non-specialist. Girls scored higher on sit and reach while boys scored higher on handgrip strength (ps<.01, $\eta2=.073$-.102). In the older group there were also main effects for teacher ($F(9,201)=2.10$, $p<.05$, $\eta2=.086$) and gender ($F(9,201)=4.364$, $p<.001$, $\eta2=.163$). Teacher differences were found for sit and reach and hand grip strength (ps<.05, $\eta2=.022$-.023), with those having a PE specialist scoring higher on sit and reach but lower on handgrip strength. Gender influenced sit and reach, handgrip strength, PACER laps, motivation/confidence, and CAPL score (ps<.05, $\eta2=.019$-.073), with boys scoring higher on all variables except sit and reach. Findings provide evidence for PE specialists' positive impact on fundamental movement skills and physical competence, particularly in earlier grades.

The role of yoga-based physical education in reducing body surveillance and promoting physical activity motivation

Cox, Anne E., Ullrich-French, Sarah, Washington State University; Howe, Holly S., University of Toronto

Mindful forms of movements, such as yoga, may help foster a more functional view of the body (e.g., lower body surveillance) and support key antecedents of intrinsic motivation for physical activity. In this study, we created a 12-week yoga-based physical education (PE) curriculum designed to support positive body image and intrinsic motivation in high school students. We hypothesized that body surveillance would decline and physical self-concept, perceived competence, autonomy and intrinsic motivation would increase from pre- to post-intervention. Further, we expected that state mindfulness during class would negatively predict state body surveillance and that change in trait body surveillance would associate with change in other outcome variables. Students participated in either yoga-based (n= 20; Mage = 16.45) or traditional (n=23; Mage = 14.52) PE. Repeated measures ANOVA results showed that yoga participants decreased ($p < .05$) in trait body surveillance but traditional PE students did not. Multi-level modeling analyses were used to examine state experiences during the yoga class only. Results support an average decrease in state body surveillance reported during class over the 12 weeks and revealed that being more mindful of one's physical experience during class predicted less body surveillance during class. Finally, regression analyses using residualized change scores showed that decreases in trait body surveillance significantly predicted increases in physical self-concept and perceived competence across the 12 weeks. The inclusion of mindfulness practice during physical education is supported as a means to positively impact body image and physical self-perceptions among adolescents.

Investigating the prevalence and risk factors of depression symptoms among NCAA Division I collegiate athletes

Cox, Charles E., St. Francis University; Ross-Stewart, Lindsay, Southern Illinois University, Edwardsville; Knuth, Alexa, Brent, Corinne, Southern Illinois University Edwardsville

This study aimed to determine an overall prevalence rate for depression symptoms among National Collegiate Athletic Association (NCAA) Division I collegiate athletes while also assessing various risk factors that may increase an athlete's vulnerability to depression. Using a sample of 950 Division I student athletes, it was found that 33.2% of athletes experienced symptoms of depression, contradicting findings from previous studies that have suggested a prevalence rate lower than the general college population. Female athletes ($p = .00$), underclassmen ($p = .01$), recently injured athletes ($p = .05$), and in-season athletes ($p = .05$), were all found to experience higher rates of depression symptoms than other athletes. It was found that 25.7% of athletes did not know how or where to access mental health treatment at their university, and 44.5% had received no mental health education from their athletic department. The results from this study suggest that depression is a more significant issue in college athletics than previously thought, and they highlight the need for continued improvements to be made in both the understanding of mental health issues in college athletics and the services that are provided to athletes.

Examining the health action process approach for people with back pain

Crawford, Derek A., Pittsburg State University; Terry, Robert, University of Oklahoma; Ciro, Carrie, Sisson, Susan, Hamilton, Toby, Dionne, Carol, University of Oklahoma Health Sciences Center

This study investigated the appropriateness of the Health Action Process Approach (HAPA), and its expansion, as it relates to physical activity (PA) participation in the back pain population. The motivational (action self- efficacy, outcome expectancies, risk perceptions) and volitional (action/coping planning, maintenance and recovery self-efficacy) constructs of the HAPA, PA, and back pain-related variables were assessed in a sample of 350 men and women who self-reported back pain. Further, disability-specific variables (e.g., disability severity) were included in the model to determine their effect on HAPA constructs. Using structural equation modeling, the HAPA model fit was satisfactory ($\chi2 = 32.86$, $p = .0003$; GFI = .97; CFI = .96; NFI = .95; and RMSEA = .08) accounting for 21% of the variance in PA intentions and 28% of PA participation. All motivational phase constructs relate to PA intention. Action/coping planning and recovery self-efficacy do not related to PA participation. PA intentions are the strongest predictor of PA participation. The expanded model (HAPA + ICF) satisfactorily fit the data ($\chi2 = 57.50$, $p < .0001$; GFI = .97; CFI = .96; NFI = .94; and RMSEA = .06) accounting for 32% of PA intentions and 29% of PA participation. Personal barriers relate to PA intentions, environmental barriers relate to action/coping planning, and disability severity effects both PA intention and participation. These data partially support assumptions of the HAPA for the back pain population. For the back pain population, interventions designed to increase PA participation must include disability- specific variables.—*NASPSPA*

Self-regulating interest and enjoyment predicts self-determined motivation and adaptive outcomes in adult exercisers

Cumming, Jennifer, Duda, Joan L., University of Birmingham

Negative perceptions of exercise as boring and unenjoyable represent a major barrier to being physically active (Rhodes, Fiala, & Conner, 2009). However, individuals can undertake specific efforts to reinterpret exercise as more interesting and enjoyable. Cumming and Duda (2010) have identified four main interest-enhancing (IES) strategies used by exercisers domain: dissociating from the activity, listening to music, providing a rationale, and adding variety. The aim of the present study was to test a model examining the relationships between IES, autonomous and controlled motivation, behavioural investment, and psychological well-being. Participants were 286 adults (M = 31.17 years, SD = 11.85; 131 female, 155 male) who completed questionnaires on IES use, perceptions of interest and enjoyment, self-determined motivation, leisure time exercise behaviour, perceived behavioural control (PBC), and chronic post-exercise feeling states. Path analysis supported a model ("²(27) = 56.35, $p = .01$, CFI = .96, TLI = .93, SRMR = .04, RMSEA = .06) showing a positive relationships between rationale and variety and autonomous motivation that was mediated by increased interest/enjoyment. Furthermore, autonomous motivation positively predicted greater self-reported exercise behaviour, PBC, and revitalization. A negative relationship was also found

between dissociation and autonomous motivation that was mediated by decreased interest/enjoyment. Both music and rationale positively predicted controlled motivation, which in turn, was not associated with any of the outcome variables. The findings provide further support for adding variety to exercise as an adaptive interest-enhancing strategy that may lead to sustained exercise routines and enhanced psychological benefits. In contrast, mixed support was found for rationale, and music and dissociation both displayed maladaptive patterns. That is, some commonly used IES strategies may inadvertently maintain negative affective judgements towards exercise and are less likely to support behavioural investment and well-being.

A process model of Ghanaian adolescents' engagement in Physical Education based on self-determination theory

Curran, Thomas, Brown, Ato A., University of Bath

Research suggests that Physical Education (PE) is an important source of Physical Activity (PA) for adolescents. Yet little is known about the motivational processes which give rise to higher affective, behavioral, cognitive, and agentic engagement in PE. In this study, we test a process model of PE engagement using self-determination theory (SDT) as a guiding framework. It was hypothesized that autonomy support (viz. volition, rationales, and choice) and structure (viz. feedback, support, and expectation) from PE teachers would indirectly predict a linear composite of affective, behavioral, cognitive, and agentic PE engagement via experiences of autonomy, competence, and intrinsic motivation. Four hundred and twenty-seven PE students (Mean age = 16.62; female N = 242; SD = 1.3) from secondary schools in the Cape Coast municipality of Ghana completed a survey containing instruments measuring the study variables. Structural equation modelling supported a fully latent process model whereby perceived autonomy support from PE teachers positively predicted autonomy, which in turn positively predicted competence, which in turn positively predicted intrinsic motivation, which in turn positively predicted engagement. Perceived structure from PE teachers, on the other hand, positively predicted competence, which in turn positively predicted intrinsic motivation, which in turn positively predicted engagement. Findings substantiate the adaptive influence of autonomy support and structure from PE teachers on adolescents' PE engagement. Yet they also offer the novel implication that, via competence, PE teacher structure may have a more direct influence on engagement than autonomy support. Hence, our results suggest that structure should be prioritized in interventions targeting adolescent engagement in PE.

Severe disciplinary incidents in men's soccer: A case study

Deal, Colin J., Pankow, Kurtis, Pynn, Shannon R., Smyth, Christine L., Holt, Nicholas L., University of Alberta

The purpose of this study was to examine the frequency of, and factors that contributed to, severe disciplinary incidents in senior men's soccer. Using a case study methodology (Stake, 1995), data were collected using documentary analysis and individual interviews. Disciplinary report documents from the past five years (n = 98), provided by the provincial (equivalent of state) soccer association, were reviewed and analyzed. The annual frequency, offender's team, level of competition, and length of suspension were recorded and descriptive statistics were calculated. The frequency of incidents increased from 4 incidents in 2010 to 27 incidents in 2015. Disciplinary incidents occurred within 80 unique (i.e., different) teams and were most prevalent in the lower levels of competition. That is, 61.1% of incidents occurred on teams in tier 3 or lower. Suspensions ranged from 0 to 134 games (M = 18.5, SD = 22.6). Additionally, semi-structured interviews (range 51-114 minutes) were conducted with seven referees (2 female, 5 male). Interviews were transcribed verbatim and subjected to a thematic analysis. Four main themes that participants thought contributed to the occurrence of severe disciplinary incidents were identified; (a) referee consistency (i.e., differences in tolerating levels of physical play and dissent from players), (b) referee education and experience (i.e., participants thought certification courses were too theory based, inexperienced referees lacked player management skills), (c) cultural differences (i.e., varying levels of physicality and emotional expression, history of conflict between teams), and (d) lack of structure at lower tiers (i.e., players lacked experience and knowledge of the rules, teams often did not have a coach to manage player conduct). This study demonstrated that the frequency of severe disciplinary incidents increased over the time period of this study, which participants attributed to referee, player, and systemic factors. These findings may provide direction for future interventions.

Associations among emotional intelligence, social perceptions, burnout and well-being in collegiate athletes
Defreese, Jonathan, Little, Sarah, Bhadury, Ashwin, Ritter, Natalie, Johnson, Aaron, University of North Carolina

Researchers have established extant knowledge on the link of sport-based social perceptions with athlete psychological outcomes including burnout and well-being (e.g., DeFreese & Smith, 2013; 2014). In examining these relationships, dispositional factors like emotional intelligence (Meyer & Fletcher, 2007) should also be considered, as they may shape athlete responses to the dynamic social environment of competitive sport. Accordingly, the purpose of the current study was to examine associations among athlete perceptions of dispositional emotional intelligence, social perceptions, burnout and well-being. We hypothesized that emotional intelligence would moderate the associations of social support and negative social interactions with athlete burnout and well-being perceptions. Participants (N = 86; Mage = 20.2 years) were American collegiate varsity and club athletes who completed valid and reliable internet-based assessments of study variables and demographic information. Hierarchical regression analyses did not support study moderation hypotheses. However, social support (ß = -0.34, $p < .01$) and negative social interactions (ß = 0.34, $p < .01$), but not emotional intelligence (ß = -0.14, $p > .05$), were found to be significant predictors of global burnout. Results were similar for all burnout dimensions with the exception of reduced accomplishment which was found to be significantly predicted by emotional intelligence (ß = -0.21, $p < .05$). Emotional intelligence (ß = 0.40, $p < .001$) and social support (ß = 0.23, $p < .05$) were both significant predictors of well-being. Study correlations also suggest emotional intelligence may be linked to more adaptive athlete social experiences. Though preliminary, study results enhance understanding of trait emotional intelligence as a potentially predisposing factor to athlete perceptions of accomplishment and well-being. This study supports continued research on emotional intelligence in sport as well as informs the development of programming designed to positively impact the psychosocial experiences of competitive athletes.

Development of para-athletes: A systematic literature review
Dehghansai, Nima, Lemez, Srdjan, York University; Wattie, Nick, University of Ontario Institute of Technology; Baker, Joseph, York University

The Paralympic Games have come a long way, from 400 athletes and 23 countries in the 1960 Games in Rome, Italy, to 4, 269 competitors from 164 countries in the most recent summer Paralympic Games in London in 2012 (Murdock, 2012). Despite the increasing media attention and societal recognition, research on para-athletes and their development has been limited, particularly compared to able-bodied studies of sport skill acquisition. Furthermore, there appears to be a lack of available training programs tailored for disabled athletes (Roy et al., 2006), which has been shown to be a relatively consistent factor in drop-out in the disabled athlete population (e.g., Williams & Taylor, 1994). The aim of our systematic review was to identify studies on development in elite para-athletes with the aim of improving training methods and performance. A total of 21 studies were identified from the Web of Science and Sport Discus databases. The conceptual categories consisted of training and practice (n=9), strength training and conditioning programs (n=7), long-term changes due to training (n=4), and skill acquisition (n=1). Study samples ranged from 6 to 125 participants and the majority of the studies explored multiple sports (n=9) with wheelchair basketball having the most sport-specific research (n=7). Only four studies used a control group for outcome comparisons, while five articles contrasted between able-bodied and para-athletes. Common themes developed from the review consisted of "the role of the coach", “success of short-term interventions", "lack of skill acquisition literature" and "compensation of body functions due to long-term exercise". There were no sport-specific developmental models located in the literature search. Future research in para-athlete development would benefit from building a comprehensive model that considers the unique constraints associated with long-term development in para-athletes.

Examining coach expectations of off-season training programs: Is sport specialization a realistic option?
DiSanti, Justin S., Michigan State University

The purpose of this study was to explore interscholastic coaches’ perceptions of attendance-expectancy for scheduled off-season activities for male and female high school basketball teams, as well as how those expectations were related to their views of specialization in high school sports. 80 high school basketball coaches (i.e., 75 male, 5 female) participated in this study, and their responses were examined in regard to their corresponding implications to

recommendations for optimized talent development by Cote's Developmental Model of Sport Participation (Cote, Lidor, & Hackfort, 2009). Participants completed a detailed measure of their perceptions of monthly activity attendance during the eight-month off-season, as well as a 10-item scale that quantified coach perceptions of contemporary issues and considerations relating to sport specialization. Results indicated that coaches generally were in favor of multi-sport participation for their athletes, though they felt that the current climate and competitiveness of high school sports make this a difficult, if not impractical, endeavor.—*Miami University*

The mediating effect of relatedness on the relationship between Facebook and exercise motivation
Divine, Alison L., Western University; Watson, Paula M., John Moores University Liverpool; Hall, Craig R., Western University

The use of Facebook has changed the way that we connect with others which in turn has the potential to affect our mental and physical health. Research on the effects of Facebook use continues to grow. However, little research has examined how Facebook impacts exercise motivation. Previous research has demonstrated that Facebook use influences self-esteem (Abellera et al., 2012), body image, weight dissatisfaction, and internalization of the thin ideal (Tiggerman & Slater, 2013), variables which are related to exercise motivation. Additionally, satisfaction of the need for relatedness can result from positive experiences derived from Facebook use and mediates the relationship between Facebook use and self-esteem (Abellera et al., 2012).Therefore, the purpose of this study was to examine how Facebook use is related to exercise motivation (intrinsic, integrated, identified, introjected, external) and whether the basic psychological need of relatedness (Ryan & Deci, 2001) act as a mediator in this relationship. A total of 318 participants from Canada and the United Kingdom completed The Facebook Intensity Scale (Ellison et al., 2007), The Psychological Needs Satisfaction in Exercise Scale (Wilson et al., 2006) and the Behavioural Regulation in Exercise -4 (BREQ-4; Markland et al., 2016). A series of mediation analysis were conducted using PROCESS macro (Hayes, 2012). The independent variables were measures of Facebook use including intensity of Facebook use, connection strategies (i.e., initiating, social information seeking and maintaining relationships), and exercise related Facebook use. Results indicated that relatedness fully. or partially mediated the relationship between multiple types of Facebook usage and exercise motivation. Specifically, different forms Facebook usage resulted in greater identified, intrinsic, integrated and introjected regulation as a result of the satisfaction of the basic need of relatedness. This study provides unique and novel findings about the role that Facebook use plays on exercise motivation.

Self-compassion and sport motivation: Do gender and class standing matter?
Dobersek, Urska, Mayol, Mindy M., Everett, Lee, Bryant, Lindsey, University of Indianapolis

Self-compassion (SC) and sport motivation (SM) have been identified as important factors in exercise outcomes and athletic success. Research suggests that these factors might differ between genders and/or class standing. The present study examined whether gender and class standing moderate the relationship between SC and SM from the self-determination theory. Two hundred and twelve student-athletes (nmen = 105, nwomen = 107 women) completed a demographic questionnaire, the Self-Compassion Scale (Neff, 2003), and the Sport Motivation Scale (Pelletier et al., 1995). Participants were Division II student-athletes (M = 19.44, SD = 1.36) from three individual and three team sports. Hierarchical regression analyses suggested that gender was not a statistically significant moderator as evident by the interaction term explaining 0.3% additional variance by the integrated regulation (ITR), $p = .40$. The interaction term was removed from the model and simple linear regression showed that SC negatively predicted ITR, $F(2, 209) = 10.20$, $p < .05$, external regulation, $F(2, 209) = 16.81$, $p < .05$, and amotivation regulation (AMR) $F(2, 209) = 16.65$, $p < .05$. Class standing was a statistically significant moderator. Simple slope analysis revealed that there was statistically significant negative relationship between SC and intrinsic regulation (IR) among juniors, $\beta = - 0.19$, $t(208) = -2.62$, $p < .01$. Among seniors there was a statistically significant positive relationship between SC and IR, $\beta = 0.237$, $t(208) = 2.99$, $p < .01$, and negative relationship between SC and AMR, $\beta = - 0.17$, $t(208) = -2.27$, $p = .02$. Knowing that the relationship between SC and SM varies depending on class standing/age could help student-athletes, coaches, and sport psychology consultants in understanding of underlying mechanisms for athletes' involvement in sport and the role of SC. This study expands previous research suggesting that the levels of SC and SM not only change with time but that this relationship is also moderated by age/class standing especially among juniors and seniors or older athletes.

Do motives for exercise matter?

Dobersek, Urska, Siegel, Amy, University of Indianapolis; Maner, Jon, Case, Charleen, Northwestern University

Research suggests that engagement in regular exercise is positively associated with quality and satisfaction with life. Specifically, high frequency and low volume exercise typically leads to higher quality of life. The strength of this relationship seems to depend on the motives for exercise. Individuals exercising for intrinsic motives tend to show higher positive relationship between exercise habits and quality of life compared to individuals exercising for extrinsic motives. The aim of the present study was to replicate previous research using college-age sample to test whether the relationship between exercise habits (i.e., frequency and duration) and satisfaction with life is moderated by the motives for exercise. One hundred and twelve (nwomen = 86, nmen = 26) participants completed two self-developed questionnaires " demographic and exercise habits questionnaire, and the Exercise Motives Inventory-2 (Markland & Ingledew, 1997) and the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985). Participants age ranged between 18 and 38 (M = 20.63, SD = 2.74). An average Body Mass Index of 25 (weight: M = 69.50, SD = 16.37; height: M = 166.96, SD = 24.15) suggested that individuals were slightly overweight. PROCESS macro (Hayes, 2014) was used to test the moderator analysis. Due to non-significant interactions, the moderator was removed from the model. Simple regression analysis suggested that exercising for Enjoyment, $b = 0.28$, $t(106) = 2.32$, $p = .02$, and frequency of exercise, $b = 0.31$, $t(106) = 2.83$, $p < .05$, positively predicted perceived satisfaction with life. The results support that exercising for enjoyment related reasons and with higher frequency is positively associated with perceived life satisfaction. Participation in exercise and physical activity may enhance physiological and psychological well-being which in turn contributes to perceived life satisfaction. This relationship can inform best practices for broad range of individuals including personal trainers, coaches, and physical education teachers among others.

Exploring self-compassion, self-esteem, and grit among Division II student-athletes

Dobersek, Urska, Everett, Lee, Mayol, Mindy M., Bryant, Lindsey, University of Indianapolis

Research suggests that self-compassion (SC), self-esteem (SE), and grit play an important role in one's well-being and sport success. Even though SC tends to better predict positive sport experiences compared to SE, they both contribute to healthier coping mechanisms in emotionally difficult situations and perseverance for long-term goals (i.e., grit). The present study explored whether SC mediates the relationship between trait SE and grit. Two hundred and sixty-six (nmen = 123, nwomen = 143) student-athletes completed the following self-report questionnaires: the demographic questionnaire, the Grit Scale (Duckworth et al., 2009), Self-Compassion Scale (Neff, 2003), and the trait Self-Esteem Scale (Rosenberg, 1965) using a paper and pencil. Participants ages ranged between 18 and 23 years old (M = 19.47, SD = 1.37). The sample was not ethnically diverse as 93.4% Division II level collegiate-athletes were Caucasian. The student-athletes were from eight different sports: cross-country and track/field (18.8%), soccer (19.2%), basketball (8.2%), tennis (5.7%), volleyball (5.3%), 51 (19.2%), softball (7.1%) and lacrosse (17.3%). The PROCESS macro (Hayes, 2012) was used to test the mediation effect. There was a significant indirect effect of trait SE on grit through SC, $b = 0.14$, BCa CI [0.09, 0.21]. This represents medium effect, $\kappa 2 = 0.15$, 95% BCa CI [0.10, 0.21]. Based on the Baron and Kenny's (1986) four-step approach, partial mediation occurred wherein trait SE significantly predicted grit after controlling for SC, $b = 0.18$, $t(263) = 3.37$, $p < .01$. Results suggest that trait SE does not directly predict grit, but more variance seems to be explained through a mediating variable SC. This finding extends previous literature in providing underlying mechanisms between trait SE and grit. At the theoretical level, it is important to provide deeper understanding of the factors contributing to perseverance and passion for long-term goals. At the applied level, findings of this study could benefit athletes, coaches, and others working within athletics.

Which type of physical activity should be encouraged to enhance perceived relatedness to others in physical activity among youth?

Dore, Isabelle, O'Loughlin, Jennifer, Fournier, Louise, University of Montreal

Social interaction is widely recognized to have a powerful effect on general physical health as well as on mental health. Many interventions including physical activity (PA) can improve social interaction among youth. The ROPAS scale was specifically designed to assess perceived relatedness to others within the context PA, based on the

Deci and Ryan's (2002) Self-Determination Theory. Frequency, intensity, group context may influence level of social interaction and, therefore, degree of relatedness to others in PA. This research aimed to identify optimal PA modalities to improve relatedness to others among youth. A sample of 1,527 post-secondary students in Quebec, Canada (58% female; mean age = 18.4, SD = 2.4) completed a questionnaire during class-time; a subsample of 1401 physically active students (91.7%) were included in this cross-sectional analysis. Multivariate linear regressions were performed to model the associations between PA modalities and relatedness to others controlling for sex, age, handicap and perceived socioeconomic status. Among active youth, no association was observed between PA frequency (number of PA sessions per week, regardless of PA intensity) and level of relatedness to others (Beta=0.003, p =0.931). However, when considering both PA frequency and intensity (METs units), a significant association with level of relatedness to others was observed (Beta=0.050, p =0.000). Those engaging in PA in an informal group setting and those involved in sports teams showed higher levels of relatedness to others (Beta=2.891, p = 0.000; Beta=5.339, p = 0.000, respectively) compared to youth who engaged in PA on their own. These results suggest that higher PA volume, as well as PA in social contexts including sports teams and informal groups, is associated with higher levels of connectedness to others in PA. Interventions that aim to enhance social interaction and connectedness through PA, should encourage youth to attain a higher volume of PA and to exercise in a group context.

Does physical activity is associated with optimal mental health among youth?

Dore, Isabelle, O'Loughlin, Jennifer, Fournier, Louise, University of Montreal

There is growing interest in physical activity (PA) to prevent mental disorders. However, very few researchers have examined the relationship between PA and positive aspects of mental health. Furthermore, specific PA modalities related to changes in mental health and mental disorders remain unclear, especially among youth. This presentation examines the associations between volume and social context of PA and positive mental health, anxiety and depressive symptoms among college students. Cross-sectional data from a longitudinal study conducted in a Quebec" college are used for the present analyses; 1527 students completed a questionnaire during class-time in October 2013 and 1454 participants (95.2%) could be included in the present analysis. Multivariate linear regressions were performed to model the associations between modalities of PA and mental health status while controlling for sex, age, handicap and perceived socioeconomic status. A positive association has been observed between volume of leisure-time PA and positive mental health (B=0.076, p = 0.000) whereas an inverse association has been observed between PA volume and symptoms of anxiety (Beta = -0.025, p = 0.000) and depression (B = -0.011, p = 0.003). Youth who exercise within an informal group show better positive mental health (Beta = 2.178, p = 0.001) compare to those who never exercise in this social context. Youth who are part of an organized sport team show higher level of positive mental health (Beta = 2.690, p = 0.006), lower anxiety symptoms (Beta = -0.539, p = 0.012) and depressive symptoms (Beta = -0.515, p = 0.002). Findings provide insight about the unique associations between specific modalities of PA and positive mental health and anxiety and depressive symptoms. Results suggests that higher volume of PA, as well as PA within informal group and team sport contexts should be encouraged so that young adults may experience better mental health and less anxiety and depressive symptoms.

The potential dark side of passion in collegiate sport: Passion as a link between moral disengagement and attitudes towards PEDs

Drewery, David, Wilson, Wade, University of Waterloo

An emerging area of research suggests that competitive collegiate athletes are at risk in terms of developing favourable attitudes towards performance enhancing drugs (PEDS; Buckman, Farris, & Yusko, 2013; Wilson & Potwarka, in press). Scholars have therefore called for an increased understanding of the factors that contribute to favourable or lenient attitudes towards PEDs for this population. An established body of research has connected moral disengagement and attitudes towards PEDs (e.g., Boardley, Grix, & Dewar, 2014; Boardley & Kavussanu, 2011). However, one factor that has received little attention is athletes' passion (both harmonious and obsessive) for their sport (Vallerand, 2010), particularly as an intervening factor in the relationship between moral disengagement and attitudes towards PEDs. This study examines whether two forms of passion mediate the relationship between selected facets of moral disengagement and attitudes towards PEDs. Collegiate athletes at Canadian universities were surveyed using previously validity measures of moral disengagement, passion, and attitudes towards PEDs. All

participants were competitive (varsity or high-level recreational) athletes playing one of seven team sports (e.g., soccer, hockey). Data were analyzed using three parallel mediation models (see Hayes, 2013). Non-responsibility and advantageous comparison emerged as significant predictors of attitudes towards PEDs. Obsessive passion mediated the influence of these factors on attitudes towards PEDs, whereas harmonious passion did not. This study positions athletes' passion, particularly obsessive passion, as a conduit between the psychological process of moral disengagement and attitudes towards PEDs. Practitioners can use this study to inform their understanding of the psycho-social processes through which attitudes towards PEDs are developed (Jalleh, Donovan, & Jobling, 2013). Specifically, these results may greatly inform the development of educational workshops for coaches and sport administrators.

An evaluation of You Can Play's high school and university playbooks

Duguay, Ashley M., Loughead, Todd M., University of Windsor; Aagenes, Anna, You Can Play

It has been shown that adolescents and young adults identifying as a sexual minority are less likely to participate in team sport than those who identify as heterosexual (Calzo et al., 2014). As such, governments and social outreach organizations have called for the development of strategies that create safe and inclusive sporting environments for lesbian, gay, bisexual, transgender, and questioning (LGBTQ) populations. For instance, in a recent report outlining amateur sport development, the Ontario government highlighted the importance of creating positive and supportive sporting environments that are free from discrimination for LGBTQ athletes, coaches, officials, and volunteers (The Ontario Government's Sport Plan, 2015). Further, You Can Play, a non-profit organization, is leading the way to ensure the safety and inclusion of LGBTQ individuals in sport. Recently, they developed The You Can Play Playbook - for high school and university athletic programs. These resources aim to provide strategies for sport programs to combat intolerance, homophobia, transphobia, and biphobia in athletics. Thus, the purpose of this project was to (1) examine participants' change agent self-efficacy and (2) collect feedback regarding the usefulness and clarity of these resources. Participants (N = 41) included high school and university coaches, and athletic directors. Participants responded very positively to the structure and content of the resources. Specifically, participants felt that The You Can Play Playbook helped them learn more about LGBTQ inclusion in sport, was easy to read and understand, and graphically appealing. They also believed the proactive and reactive strategies were useful and would be easy to implement with their teams. Finally, participants felt the language guide within The You Can Play Playbook helped them better understand important LGBTQ terms and definitions. Findings are discussed in terms of creating safe and inclusive sporting environments for sexual minority populations and future directions in evaluating these resources.

Does a single bout of "green exercise" facilitate engagement in future exercise behavior? A one-year follow-up pilot study

Dyke, Ford B., Miller, Matthew W., Buchanan, Taylor, Crawford, Beverly, Auburn University

An enhanced affective experience during a bout of exercise is positively correlated with future exercise engagement. Thus, it is important to explore means by which to enhance the affective experience of exercise. One way to do so may be to exercise in the presence of nature (i.e., engage in "green exercise"). This is because green exercise may be more pleasant than exercise completed in "artificial environments" (e.g., urban settings). Therefore, individuals who engage in a bout of green exercise may exhibit more participation in future exercise when compared to those who engage in a bout in an artificial environment. The purpose of the present study was to test this hypothesis. Specifically, we investigated whether individuals who engaged in a bout of green exercise reported more exercise behavior 1 year later compared to individuals who engaged in a bout of exercise in an artificial environment. Forty low-active adults completed one 10-min bout of walking, at a self-selected pace, in either a green or artificial environment. Participants' exercise behavior in the week proceeding the bout and post-treatment (1 year later) was indexed by way of the Stanford 7-day Physical Activity Recall Scale. A manipulation check questionnaire revealed the green environment was perceived as more natural than the artificial environment ($p < .001$). Nonparametric tests of the delta scores (exercise behavior 1 year after green/artificial exercise bout minus exercise behavior prior to bout) failed to reveal a significant group (green vs. artificial) difference ($p = .110$), although group differences were in the predicted direction (the green exercise group reported more moderate- vigorous physical activity). Thus,

results failed to support the hypothesis, however it is possible that a higher-powered study (e.g., larger N) could have yielded significant results.

Slow walking on a treadmill workstation does not impair executive functions

Ehmann, Peter J., Brush, Christopher J., Olson, Ryan L., Bhatt, Shivang N., Banu, Andrea H., Alderman, Brandon L., Rutgers University

The combination of modern sedentary lifestyles with rising obesity levels has increased attention on novel approaches to enhance physical activity. One approach that has received increasing research attention is the use of an active workstation in the workplace. A treadmill desk is a workstation that allows users to stand or walk on a treadmill while continuing normal work activities. Although several recent studies have suggested little influence of walking on a treadmill desk on cognitive function, little is known about the possible subtle influences on executive function. The aim of this study was to evaluate the effects of walking at a self-selected low-intensity pace on an active workstation while simultaneously performing executive function tasks. Executive function was assessed using the Towers of London (global executive function), Sternberg (working memory), Stroop (inhibition), and Wisconsin Card Sorting (cognitive flexibility) tasks. In a within-subjects design, 30 participants (11 females; 21.7 SD 3.4 years) completed a seated control and low-intensity treadmill walking condition in random order on separate days, while performing the executive function test battery. Separate ANOVAs for reaction time (RT) and accuracy for each task showed the expected set size (working memory) and congruency (inhibition) effects (all $Fs > 4.3$; $ps < 0.05$). However, no treatment main effects or interactions were found (all $Fs < 2.1$; $ps > 0.17$), indicating no benefits or impairments in executive function during slow-walking on a treadmill desk. These findings suggest that executive function performance remains relatively stable while using an active workstation compared to sitting. Because of the associated health benefits of increased physical activity, the findings support implementing active workstations into office environments without any disruptions to job performance tied to executive function abilities. Future research should study older adults who may be more prone to detriments during a dual-task situation.—*Rutgers Aresty Research Center*

Predicting physical activity in adolescents through enjoyment and motivation: composite variables in mediation models

Elliot, Catherine A., Lincoln University; Seelig, Harald, University of Basel; Hamilin, Michael, Lincoln University

Research indicates that adolescent physical activity (PA) engagement positively correlates with motivation and PA enjoyment. The objective was to determine if vigorous physical activity (VPA) could be predicted by PA enjoyment and motivation. Using the self- determination theory, motivation was measured for PA in the settings of leisure-time (LTPA) and physical education (PE). A cross-sectional self-report questionnaire of 715 adolescents (age 11-19) from 5 secondary schools in Switzerland was collected. The instrument included the International Physical Activity Questionnaire (IPAQ), Situational Motivation Scale (SIMS) and Physical Activity Enjoyment Scale (PACES). IPAQ scoring guidelines were implemented to compile metabolic equivalents of task (METs) for VPA. The SIMS queried motivation for PA in LTPA and PE, then aggregated scores on the relative autonomy index. A mean score was generated for PA enjoyment. Separate regression analyses were executed for LTPA and PE motivation on VPA, controlling for age, sex, and migration status. VPA was significantly predicted by motivation in both LTPA ($R2= .08$, $\beta = .229$, $p\leq .001$) and PE ($R2= .04$, $\beta =.128$, $p\leq .001$). PA enjoyment was significantly correlated ($p\leq .001$) with motivation for LTPA ($r=.64$), PE ($r=.51$) and VPA ($r=.33$). A regression analysis with PA enjoyment as additional predictor variable suggested that VPA was predicted by PA enjoyment ($\beta= .289$, $p\leq .001$) rather than motivation for LTPA ($\beta=.049$, $p=.300$). Similarly, VPA was predicted by PA enjoyment ($\beta= .363$, $p\leq .001$) rather than motivation for PE ($\beta= -.058$, $p= .178$). Higher motivation levels for LTPA and PE were related to higher adolescent VPA levels. However, the predictive power of LTPA and PE motivation disappeared when PA enjoyment was added to the models. LTPA and PE models indicated that PA enjoyment had mediation effects on the relationship between motivation and VPA.

Effects of different types of self-talk under higher stress in archery performance
En-Hsin, Li; Li, Chung-Chih; Chang, Yu-Kai; National Taiwan Sport University

To achieve high performances, archers are required to have high levels of psychological ability and psychological skills, such as goal setting, motivation self-confidence, relaxation, imagery training, and self- talk. Among these attributes, the importance of self-talk has been clearly recognized. Previously referred literatures have observed that positive self-talk enhances athletic performance. Some other studies have also revealed that positive self-talk promotes adversity adaptability relative to increasing athlete motor performance and is thus useful to improving archery performance. It should be noted that, however, several types of self-talk have been proposed, and whether these types of self-talk influence archers' performances, particularly under high levels of stressful situations, remains unknown. The purpose of this present research attempts to determine the differences between archer performances as potentially affected by five different types of self-talk. Thirteen professional archers were recruited from the National Taiwan Sports University. They experienced five types of self- talk, including positive instructional self-talk, negative instructional self-talk, positive motivational self- talk, negative motivational self-talk, and non-related self-talk. Their performances involved two rounds with six arrows per round. Archers drew from a lottery specifying 7, 10, 12, and 15 seconds before each shoot, and they had to shoot within the required time. The main results of this study revealed that there were significant differences among the effects of the five types of self-talk. Specifically, Positive instructional self-talk had a better score than negative instructional self-talk, as well as Positive instructional self-talk and positive motivational self-talk having more effective scores than negative self-talk. These findings suggest that the types of self-talk may be associated with sport performances under highly of stressful conditions, and may thus provide the foundation for selecting the specific type of self- talk that is most effective in producing positive results.

Effects of an aerobic fitness test on short- and long-term memory in elementary-aged children
Etnier, Jennifer L., Shih, Chia-Hao, Sprick, Paul, Glass, Stephen M., Labban, Jeffery D., University of North Carolina Greensboro

Research has shown that acute exercise benefits cognitive performance. In addition, a meta-analysis indicates that this effect is transient (Chang et al., 2012). Specifically, the beneficial effects of acute exercise are most robust within 15 min of exercise and become negligible after that. However, in contrast to these findings, a meta-analytic review focused on the effects of exercise on memory showed that acute exercise has a small effect on short-term memory (STM; SMD=.26), but has a moderate effect on long-term memory (LTM; SMD=.52) (Roig et al., 2013). Given these mixed findings, the purpose of the current study was to test the effects of acute exercise on memory immediately (STM) and 24-hr after (LTM) a single bout of exercise. Because we were also interested in age and sex as moderators of these effects, this study was conducted with 2nd, 4th, and 6th grade boys and girls. Children (boys: n=50; girls: n=55) were randomly assigned to either the run-first (n=49) or the memory-first (n=56) condition. Children assigned to the run-first condition were asked to jog (~100 m) and stretch prior to starting an aerobic fitness test. They then ran their assigned time (10 min) or distance (1 mile) at maximal voluntary intensity. The auditory verbal learning task (AVLT) was administrated immediately after the run. Students assigned to the memory-first condition performed the AVLT first then completed their aerobic fitness test. LTM data was collected the next day. After controlling for fitness, results showed significant main effects of grade on both STM and LTM (p's<.01) with better performance by 4th and 6th graders than 2nd graders. Importantly, a significant interaction between gender and condition was found on LTM (p<.05). Specifically, facilitating effects of acute exercise were found in male students but not female students. Future research will be necessary to further our understanding of this finding and to advance our knowledge regarding how acute exercise might best be used to benefit memory and ultimately to influence cognitive performance more broadly.

Youth sport coaches' perceptions of a humanistic coaching approach
Falcao, William R., Bloom, Gordon A., McGill University; Bennie, Andrew, Western Sydney University

Humanistic coaching focuses on promoting athletes' personal growth and development by empowering athletes and fostering positive coach-athlete relationships (Lombardo, 1987; Lyle, 2002). As a result, it has been commonly implemented in youth sport coaching as a way to enhance the holistic development of young people (Donnelly,

2000; Cassidy, 2013). In fact, coaches have reported adopting strategies that reflect humanistic practices without even being aware of its principles (McMahon & Zehntner, 2014). This has led to a wide range of interpretations of humanistic coaching and an unclear understanding of what it is and how it can be applied to sport (Cassidy, 2010). This is not surprising given that humanistic strategies are rarely taught in coach training contexts (Nelson et al., 2014). As such, the purpose of this study was to develop a humanistic coach training program and to investigate youth sport coaches' perceptions of this educational approach. Participants were 12 high school basketball coaches who were coaching in low socio-economic communities of a major Canadian city. Semi-structured interviews were conducted three months after the coach training program. This allowed coaches time to implement the strategies into their basketball training sessions and games, and to form perceptions about this approach. Interviews were transcribed verbatim and organized into themes and subthemes using a thematic analysis (Braun & Clarke, 2013; Sparkes & Smith, 2014). The results indicated that coaches learned the main principles of humanistic coaching and felt it benefitted both themselves and their athletes in many ways. For example, they learned to empower athletes, foster autonomy, encourage decision-making, and build confidence using questioning and problem solving strategies. Additionally, they became better communicators, which helped them build positive relationships with their players. This presentation will share some of the strategies used by the coaches and will discuss the findings based on humanistic coaching principles.

A tale of two cities: Exploring inter-city variability in the development of National Hockey League players from Ontario and Quebec.

Farah, Lojain, University of Ontario Institute of Technology; Schorer, Jörg, University of Oldenburg; Baker, Joseph, York University; Wattie, Nick, University of Ontario Institute of Technology

Research has shown that the population size of one's birthplace can have a considerable influence on the chances of becoming an elite athlete. Of note, Canadian cities with populations of 30,000 to 249,999 tend to develop disproportionately higher number of National Hockey League (NHL) players (Cote et al., 2006; Baker & Logan, 2007). However, it is not clear whether all cities with similar populations produce the same number of NHL players. This study aimed to compare cities within each census population size category (< 2,500; 2,500-4,999; 5,000-9,999; 10,000-29,999; 30,000-99,999; 100,000- 249,999; 250,000-499,999; 500,000-999,999; >1,000,000) in order to determine if cities of similar size are equivalent in their production of NHL players. Birthplace data were collected for NHL players from the provinces of Ontario (n = 562) and Quebec (n = 242) drafted from 2000- 2014. Canadian census data were used to determine the population size of each player's birthplace city. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated to quantify the likelihood of an athlete emerging from their specific birthplace city within its respective population category (assuming all cities should produce equal number of athletes). Results revealed variability within population categories. For example, cities within the 100,000-249,000 (n = 15) and 500,000-999,999 (n = 4) population categories in Ontario varied in the likelihood of producing NHL athletes (OR ranges = 0.12 to 2.29 and 0.09 to 2.74, respectively). Similar results were observed for cities in Quebec (e.g., 100,000-249,000 category OR range = 0.54 to 1.93), suggesting variability exists within the population categories themselves (within each province). These results imply that two cities of the same population size may not have equivalent athlete development environments. Future research should consider these findings as they apply to NHL athletes from other provinces within Canada, and why some cities produce more athletes than others despite having similar populations.

Do elite soccer and volleyball athletes show better performance in perceptual-cognitive skills?

Fleddermann, Marie-Therese, Heppe, Holger, Zentgraf, Karen, University of Muenster

The expert performance approach studies the sports athlete under a sport- specific context (Starkes & Ericsson, 2003), whereas the cognitive component skill approach focuses on more fundamental, sport-unspecific cognitive demands (Nougier et al., 1991). A recent meta-analysis by Voss et al. (2009) shows that athletes perform better in some perceptual-cognitive skills than non-athletes such as processing speed and different attentional measures. Faubert (2013) finds a benefit for elite athletes in divided attention measured via a 3D multiple object tracking task (3D_MOT). The aim of this study was to further investigate the relationship between the level of sport expertise and fundamental cognitive skills. We hypothesized that elite athletes would show higher performance in fundamental cognitive skills than semi-elite athletes. 42 soccer (6 females) and 32 volleyball players (23 females) with different

expertise levels performed a test on information processing speed (a German version of the trail-making test, "ZVT", Oswald & Roth, 1987), a letter-read-out speed and working span test ("KAI-N", Lehrl & Blaha, 2001), a sustained attention test ("d2-R", Brickenkamp et al., 2010) and the 3D-MOT. Participants were categorized into three expertise groups (elite, semi-elite, non-elite athletes; calculated by e.g., league, participation, playing time etc.). ANOVA revealed no significant main effect of group, $F(2,53) = .146$; $p = .86$, $\eta p2 = .005$, and no significant interaction between cognitive test and group, $F(6,5159) = .183$; $p = .88$, $\eta p2 = .007$. We found only a weak correlation between ZVT and the parameter "league" of expertise index ($r= 0.29$). The results are not in line with our hypothesis and studies (Faubert 2013, Voss et al., 2009) reporting an advantage of elite athletes mostly compared to physically non-active subjects. The results of this study indicate that cognitive performance differences between elite and semi-elites are only small and might be related to the currently unknown boundary conditions related to sport-specific and sport-unspecific context.

Coping with pain: A survey of college athletes

Flores, Stephanie, Barker, Rachael, Avans, Diana, Vanguard University

To an athlete, pain is a part of the game. Athletes with a strong athletic identity are more likely to play through injury (Howard, 2013). To do this, athletes must develop coping strategies. Through clinical research using the Coping Strategies Questionnaire (CSQ), three strategies were identified: diverting attention or praying, cognitive coping and suppression, and helplessness (Rosenstiel, 1983). Subsequent research identified six sub-scales: pain catastrophizing, distraction from pain, ignoring pain, reinterpreting pain sensations, self-affirmation and praying (Monticone, 2014). This adapted assessment has been used with athletes in only one study using combat athletes (Deroche, 2011). The purpose of this study was to utilize this questionnaire with team-sport collegiate athletes. We hypothesized that male athletes would be more likely to ignore pain and female athletes would use catastrophizing strategies. One hundred athletes completed the CSQ and 3 questions to assess current levels of pain, modifications required to continue playing, and modifications to training. Descriptive statistics and t tests were used. Seventy-six percent reported currently experiencing moderate to intense pain with 59% making modifications to continue playing. The top three strategies were Ignoring Pain, Self-talk, and Distraction. The least used strategy was praying. There were no significant differences in coping strategies based on gender. The only strategy that approached significance was the use of prayer with men using this less ($p = 0.092$). These findings did not support our hypotheses. Pearson Correlations identified the coping strategies that were related to each other. Significant relationships included: Pain catastrophizing with pain experience and prayer; Ignoring pain with reinterpreting and self-talk; Reinterpreting pain with distraction and self-talk. Although coping strategies were identified, gender differences in coping were not. This is contrary to other pain coping strategy research conducted within the health care field and warrants further exploration.

What do breast cancer survivors need to be active? An analysis of desired physical activity related resources

Fong, Angela J., Sabiston, Catherine M., University of Toronto

More than 80% of breast cancer survivors (BCS) do not currently meet recommended physical activity (PA) guidelines for health benefits (i.e., 150 minutes of moderate-to-vigorous PA). This may partially be due, in part, to a lack of appropriate PA resources available to BCS. The purpose of this study was to identify the unmet needs experienced by BCS in Canada. Participants (N=111) were Mage=55 (SD=13.3) years; 87% Caucasian; 67% Stage I or II breast cancer; and 7 (SD=7.1) years post treatment. BCS reported low levels of PA (M=63.05, SD=53.2 weekly minutes of PA). Women indicated wanting to increase their current levels of PA (64.4%). Overall, BCS were not confident in their ability to obtain advice from PA professionals who understand cancer (41.4%), in finding an exercise partner who understands cancer (61.1%) and in finding others to motivate them to exercise (44.5%). BCS reported the following resources would be useful for increasing current PA levels: role models for PA information (31.5%), PA monitoring devices (37.3%) and access to PA professionals (35.8%). Based on these results, there are numerous modifiable unmet PA needs reported by BCS. Meeting the needs of BCS is an important target for developing future supportive PA programming and resources and enhancing regular PA behaviour. Future research is needed to inform the development of PA resources, and to implement and evaluate PA programs and resources based on the unmet needs identified in the current study.—*Canadian Breast Cancer Foundatin*

Psychosocial outcomes of a six-month pedometer-based walking program for rural older adults
Forlenza, Samuel T., Meyer, Benjamin, Bourassa, Dara, Paulson, Sally, Sanders, Joohee, Shippensburg University

Staying active throughout older-adulthood is linked with greater psychosocial well-being (Parker et al., 2008). However, older adults are the least active age group, with inactivity rates being even higher for older adults in rural areas (CDC, 2013). The purpose of this project, therefore, was to utilize a pedometer-based goal setting intervention to increase physical activity levels and psychosocial wellbeing in rural older adults. In conjunction with an area senior center, older adults (Age = 71.8 years) volunteered to participate in a walking program (WP; n = 15) or control group (CG; n = 4). Participants in both groups received pedometers to wear on the hip. WP participants received a weekly goal to increase their average daily number of steps by 1,000 each week until they averaged 10,000 steps, which they were to maintain for the 6-month program. WP participants also received walking maps created by a geoenvironmental studies student and were encouraged to walk those routes in groups weekly to facilitate social connections and physical activity. Every three months, all participants completed the Positive and Negative Affect Schedule, Walking Self-Efficacy Scale, Balance Self-Efficacy Scale, Social Connectedness Scale, Satisfaction with Life Scale, and Short-Form 36. Results indicated that WP participants significantly increased their steps over the course of the program (from a daily step average of 4573 to 7232, $p = .02$), while CG participants did not (2316 to 2250, $p = .84$). A series of 3 (Time: Baseline, Month 3, Month 6) x 2 (Condition: WP, CG) repeated measures ANOVAs were conducted on the psychosocial measures. A significant interaction emerged for balance self-efficacy, $F(2,26) = 3.78$, $p = .04$. Follow-up t-tests showed the strength of WP participants' self-efficacy beliefs about balance increased significantly ($p = .03$) from Baseline (82.36) to Month 6 (89.26), while CG participants experienced a decline from Baseline (85.37) to Month 6 (76.30). Ceiling effects and a small sample size likely prevented additional significant effects from emerging.

Training, experience, effectiveness and perceptions towards sports psychology consultants: A systematic review
Fortin-Guichard, Daniel, Boudreault, Veronique, Trottier, Christiane, Universite Laval

The first scientific papers on sport psychology consultants (SPCs) were published during the 1980s and primarily focused on the professional practice of experienced SPCs. Since then, the scientific literature on SPCs has greatly diversified; however, no review has been conducted to assess this literature and extract key findings. Therefore, the objective of this study was to review and analyze this literature, extract the main results and provide a critical examination of these findings. Two hundred twenty two peer-reviewed scientific articles published in English were found in the databases SPORTDiscus, PsycNET, PubMed, ERIC and in the search engine Google Scholar. Four main themes emerged from the analysis of these articles: training of SPCs, experiences of SPCs, perceptions toward SPCs and effectiveness of SPCs. The main results in relation to each theme and limitations of these studies are discussed. The conclusion suggests future avenues from which to develop research on SPCs.

Trickle down effect: Exploring the role of the Olympic games in facilitating preschoolers' development
Fraser-Thomas, Jessica L., Safai, Parissa, York University

Trickle down effect refers to the assumption that mega-events such as the Olympic Games positively influence grassroots sport and physical activity participation. While little empirical evidence supports this effect (Craig & Bauman, 2014), there is growing interest in Major Games' legacies in line with Olympic Movement values (e.g., education, friendship, fair play). Positive youth development (PYD), a strength-based approach to child and adolescent development (Lerner et al., 2005), offers a lens to explore the role of the Olympic Games in preschoolers' development. Interest in understanding preschoolers' experiences was based on trends of sport participation at increasingly earlier ages, and young children's impressionability. Participants included parents of preschoolers (N=19), childcare providers (N=8), and preschoolers (N=57, ages 2-5) recruited through childcare centres in Ontario, Canada. Participants engaged in semi-structured interviews and focus groups in the spring of 2012 (pre-London Olympic Games) and the spring of 2013 (one year post-Games). While children showed only minimal awareness of the Games at both time points, parents and childcare providers saw the Games as a vehicle to teach preschoolers about pro-social values (e.g., work ethic, perseverance, teamwork, role models), and the complexities of winning and losing (i.e., doing one's best, being a good sportsperson, experiencing disappointment and pride).

Preschoolers appeared to gain an enhanced sense of national identity through the Games, evidenced in their recognition their nation's flag/anthem, and discussions about countries' geographies, flags, and cultures. While these learning outcomes are not traditionally encompassed when considering the trickle down effect, the Games, coupled with active adult engagement, may offer a platform for the facilitation of some specific developmental opportunities among preschoolers. Study limitations, future directions, and contributions to PYD research are discussed.

The role of focus and confidence in high-level athletic performances

Gagnon-Dolbec, Alexis, Orlick, Terry, University of Ottawa

Despite the ability for past studies to link various psychological factors to optimal athletic performances the roles of specific factors have yet to be fully discerned. The large numbers of psychological skills related to peak athletic efficiency suggests that a complex relationship exists between psychology and sport performance. Consequently, it becomes important to understand the in-depth intricacies of the functions that psychological features enact upon athletic performances. Using a phenomenological-constructionist approach, the present study aims to gather a sharpened understanding of the roles that confidence and focus have on elite sport performances. Particular attention was allotted to the effects these two factors incur during athletes' best and worst performances. Semi-structured interviews were conducted with 12 Canadian and Norwegian high-level athletes (international and/or professional) originating from various sporting backgrounds. The athletes were interrogated about their general perspectives towards confidence and focus, inquired about the nature of their focus with regards to different game situations and asked to revisit their best and worst performances with the emphasis put on their confidence level and focus. The analysis of the interviews was inductive and followed Giorgi's (1985) phenomenological methodology. Results suggested that an optimal focus is very often, if not always, present in best performances and largely absent during worst performances, thus suggesting that focus plays a direct role on sporting exploits. Furthermore, confidence appears to serve as a powerful facilitator for the occurrence of optimal focus, leading to suggest that its relationship with performance might be more indirect. The increased understanding of the roles that both confidence and focus have on athletic performance that is enlightened by this study can serve as basis for practitioners in the development of performance enhancement programs in addition to stimulate future research on the possible relationship between confidence, focus and performance.

Body-related social comparisons in men: Effects on social anxiety and strength outcomes

Gammage, Kimberley L., Crozier, Scott, Gabriel, David A., Brock University

A large body of literature has shown social comparisons to an ideal are associated with negative body image. However, the majority of this research has been with women. One setting in which social comparisons may be particularly relevant for men is in strength-training settings. This study manipulated social comparisons with a personal trainer during one-repetition maximum (1-RM) chest press and leg press tests to examine the effects on body-related social anxiety and performance during maximal strength tests. Ninety-nine college men with a minimum of six months of weight training experience were randomly assigned to complete a 1-RM protocol with either a muscular male trainer described as an expert or a lean male trainer described as a novice. Participants completed a completed a measure of body-related social anxiety prior to and following the completion of the 1-RM tests under the supervision of their respective trainers. They also completed a measure of social comparison following the manipulation. Participants in the muscular, expert trainer group reported more negative social comparisons to the trainer than those in the lean, novice trainer group on both strength and muscularity. They also reported higher body-related social anxiety ($F(1, 96) = 5.09$, $p = .03$, $\eta 2 = .05$) and lifted more weight during both these chest press and leg press 1-RM tests press ($t(97) = -3.21$, $p = .002$, $d = 0.65$ and $t(90) = -3.27$, $p = .002$, $d = 0.69$ respectively) than those in the lean, novice trainer group. These results provide evidence that an upward comparison may lead to enhancements in strength performance in men. However, trainers must also be aware that their own characteristics may lead to negative psychological outcomes (i.e., social anxiety).

The effects of a telehealth exercise program on self-efficacy and adherance in individuals with Parkinson's disease

Garcia, Liz, Todd, Teri, Samson, Ashley, Narasaki Jara, Mai, Stone, Robert, Angulo Barroso, Rosa, Wagatsuma, Mayumi, Jung, Taeyou, California State University, Northridge

Self-efficacy (SE) to exercise is a strong determinant of participation in formal exercise programs for individuals with Parkinson's disease (PD). Additionally, fear of falling, travel distance, and lack of qualified professionals may limit access to supervised exercise programs. Advances in technology such as video-conferencing may make it easier for people with PD to connect with qualified exercise practitioners and experience benefits of regular exercise. To investigate the effects of a telehealth exercise program (THEP) on SE to exercise, adherence to an exercise program, and fall efficacy for individuals with PD. Secondary outcomes of quality of life were also of interest. A total of six adults with idiopathic PD (Hoehn and Yahr scale 1-3) completed individual THEP (one hour, 2x/week, 12 weeks) through video-conference. SE to exercise was evaluated using the Self-efficacy for Exercise Questionnaire (SEE) and adherence was measured by the number of sessions completed. Fall efficacy was measured by the Fall Efficacy Scale- International (FES-I). The Parkinson's Disease Questionnaire-39 (PDQ-39) was completed for insight into quality of life. Data was collected pre, mid, and post intervention. Participant adherence throughout the intervention was high (96.52%). SE to exercise increased 5.7% from pre- to mid-intervention (pre: 58.83; mid: 62.17); however at post-intervention scores returned near baseline. No changes were found in FES-I scores. PDQ-39 sub scales of Stigma and Cognition showed substantial improvement; 27.3% (pre: 22.92; post: 16.67) and 13.9% (pre: 37.50; post: 32.29). Individuals with PD were receptive to THEP as shown in the high rate of adherence and benefits were noted in several aspects of well-being. Though SE to exercise and fall efficacy did not increase over the 12 week program it may be that the individuals who volunteered for the program were more active than the general PD population. Our findings suggest that THEP may be an effective method to provide exercise programming to individuals with PD.

Social support profiles in youth sports: Implications for motivational outcomes and continued participation

Gardner, Lauren A., Vella, Stewart A., Magee, Christopher A., University of Wollongong

This study sought to explore whether individual differences in social support in youth sport (based on relationships with parents, coaches, and peers) fall into distinct profiles. Additionally, we investigated whether these profiles differed in levels of enjoyment and intention to continue in sport, and whether these differences were moderated by age and gender. Regular sports participants (N = 313) with a mean age of 13.03 years (SD = .84) responded to questionnaires assessing perceived parental support, coach-athlete relationship quality, perceived friendship quality, perceived peer acceptance, enjoyment, and intention to continue. A Latent Profile Analysis revealed four distinct profiles: high social support (45.1%), low social support (19.8%), high coach/low friendship (19.8%), and high friendship/low coach (15.3%). The high social support profile and the high coach/low friendship profile reported relatively greater levels of enjoyment when compared to the low social support profile and the high friendship/low coach profile. Similar results were observed for intention to continue, however, intentions did not differ between the high coach/low friendship profile and the high friendship/low coach profile. The observed differences in enjoyment and intention to continue between the profiles were not moderated by age or gender. Results highlight the value of investigating combinations of relationships with all three social figures in youth sports. The findings suggest that the coach-athlete relationship may be of particular importance and may compensate for a lack of other supportive relationships in this age group. Findings could have important implications for understanding youth sports participation and dropout, which in turn could aid in improving physical and psychosocial health outcomes among children and adolescents.

Aesthetic experience in appreciating sport photos -Physical and psychological signals

Gau, Li Shiue, Lin, Yu-Ting, Hung, Meng-Tsung, Chen, Sih-Huei, Chang, Kang-Ming, Asia University, Taiwan

This study focuses on the aesthetic experiences at sporting settings using experience economy theory (Pine & Gilmore, 1998, 1999, 2011). The beauty, grace, and other artistic characteristics in sports (Trail, Anderson, & Fink, 2000; Willis & Campbell, 1992) such as figure skating, synchronized swimming, sport dancing and gymnastics (Milne & McDonald, 1999) can be greatly appreciated for their unique intrinsic values when watching sports (Gau

& James, 2013). This study uses 10 sport photos as stimuli for participants to look at. Meanwhile, used as contrast stimuli were 10 watercolor paintings drawn by one of coauthors using different lighting and shadowing techniques along with scenic elements of stones, rivers, trees and houses in rural areas. It is hypothesized that participants' emotion will be aroused with aesthetic experiences when observing these photos and paintings. However, the experience will be influenced by the level of participants' previous involvement with sports and arts activities. At a university in central Taiwan, 38 research participants were recruited (14 males and 24 females). Electroencephalography (EEG) and heart rate variability (HRV) were collected when participants viewed the sports photos and art paintings. Additionally, prior to viewing the slides, participants answered items about level of involvement with sports and arts activities. After watching the slides, participants answered questions about aesthetic experiences in appreciating sports photos and watercolor paintings. The results show that the scores of experiential scales, i.e. psychological signals, indicate aesthetic experience is aroused in sports photos. No experience difference of the means is found between viewing sports photos and art paintings. Participants who were more involved in sports activities seem to have stronger experiences in watching sports photos than participants who were less involved. Physical signals in HRV show that participants who were more involved in arts activities feel more relaxed when watching art paintings than those who were less involved.

Examining the correlates of exploration activities for senior high school students in Taiwan

Gau, Li-Shiue, Chang, I-Hsun, Kuo, Chun-Hsien, Asia University, Taiwan

This study examines correlates of exploration activities, focusing on personality (agreeableness, openness to experience, extroversion), preparedness (interest in participation, positive activity expectation, willingness to change), experiential education mechanism (mutual support, empowerment, reflection), and team-work ability. It is hypothesized that exploration activities have positive effects on team-work ability, but the effects are influenced by participants' personality, preparedness and the process of the activities in terms of experiential education mechanism. Participants who are more positive in preparedness and have personality of more agreeableness, openness, and extroversion, will enjoy more positive experiential education mechanism and acquire more positive effects on team-work ability. An experimental pre-post test design was used. The experimental group had 74 participants while the contrast group recruited 68 participants from senior high school students. The experimental group attended the training of exploration activities for three days at Sha Lian Dun outdoor camp in central Taiwan and filled out questionnaires prior to, after the camp, and also 64 days following the camp. Examples of exploration activities included group rope-activities, forest adventures, paintball competitions and life skill activities. Prior to the camp, participants answered questionnaires about personality, preparedness and team-work ability. After the camp, participants responded to questions about experiential education mechanism and team-work ability. Then, 64 days after the camp, items of team-work ability were answered again. The contrast group, which did not attend the training camp, did not answer items of preparedness and experiential education mechanism. The results showed that the training activities have positive effects on participants' team-work ability and the effects extend after 64 days. The training effect is the most linked to experiential education mechanism further influenced by participants' preparedness and the personality of agreeableness.

Validation of measures to assess cognition and quality of life in older adults

George, Amanda M., Ploughman, Michelle, Rohr, Linda, Memorial University of Newfoundland

With so many questionnaires available for researchers, using validated measures ensures that the data gathered is reliable and accurate. This is particularly important for subjective tests. Efficiency during data collection is also important; therefore it is necessary to ensure metrics selected for research purposes are evaluated and selected carefully. Purpose: The purpose of the study was to determine the reliability of objective and subjective questionnaires used to evaluate cognition (Montreal Cognitive Assessment, Informant Questionnaire on Cognitive Decline in the Elderly, and the Psychogeriatric Assessment Scale) and quality of life (Assessment of Quality of Life " 8 Dimension and the Qualidem). Correlations between questionnaires were also explored. Questionnaires to assess cognition (MoCA, PAS) and quality of life (AQoL-8D) were administered to 18 subjects (age 65 to 79) at four time points over six months. These variables were also assessed by questionnaires (IQCODE, PAS, and the Qualidem) administered to informants at the same time intervals. Internal reliability was found to be high for the quality of life measures ($\alpha = .887$, $\alpha = .920$); and the subject and informant measures of quality of life were highly correlated (p =

.023). Internal reliability of cognitive measures varied ($\alpha = .326$ to $\alpha = .888$); the correlation of the scales followed the trends found in previous research. Subject and informant measures of cognition (MoCA and IQCODE) and quality of life (AQoL-8D and the Qualidem) were significantly correlated ($p < .05$). The selected measures provide reliable data and generally measure the same constructs as one another. Utilizing them together could improve accuracy of results for evaluating cognition and quality of life in older adults.—*Newfoundland and Labrador Centre for Applied Health Research*

Currently felt emotions and anticipated emotions predict future physical activity: An examination of pride and shame

Gilchrist, Jenna D., University of Toronto; Conroy, David E., The Pennsylvania State University; Sabiston, Catherine M., University of Toronto

Emotions play a critical role in helping people adapt their behavior to changing relational circumstances. Anticipated emotions, predicting how one will feel in the future, may also guide behavior based on the desired emotional outcomes individuals expect from engaging in a behaviour. Participants (N = 158, 76% women; Mage = 35.51, SD = 10.29) training for a marathon/half-marathon completed a weekly online questionnaire after five training runs immediately preceding a race. Each week participants reported their anticipated pride and shame if they met and did not meet their goals for the race, respectively, the intensity of pride and shame experienced during their run, and their training behavior that week. Multilevel models were estimated to test hypothesized associations between experienced and anticipated emotions and future training behavior after controlling for age, gender, and temporal proximity of the race. Time spent training increased following weeks when participants reported experiencing less pride than usual ($\beta = -21.12$, SE = 7.11, $t(320) = -2.97$, $p < .05$) and was greater for participants who usually reported experiencing more shame than others ($\beta = 79.61$, SE = 34.14, $t(151) = 2.33$, $p < .05$). Participants reported putting forth more effort towards their training following weeks when they felt less pride than usual ($\beta = -0.34$, SE = 0.09, $t(319) = -3.88$, $p < .05$) and was greater for participants who usually reported experiencing more pride than others ($\beta = 0.31$, SE = 0.08, $t(151) = 3.65$, $p < .05$). Lastly, individuals put forth more effort towards training following weeks when they anticipated experiencing less than the maximum amount of pride when meeting their goal for the race than others ($\beta = -.46$, SE = 0.22, $t(151) = -2.11$, $p < .05$). These results extend recent conclusions that affective responses predict future physical activity by highlighting the differential roles of two discrete emotions in that process.

Does motivation to exercise change as a result of a rehabilitation intervention in Parkinson's disease

Godfrey, Michael J., Beck, Eric N., Intzandt, Brittany, Almeida, Quincy J., Wilfrid Laurier University

Parkinson’s disease (PD) is a movement disorder in which pharmacological therapies only mask motor symptoms, while it has been argued that exercise can reliably reduce the symptom severity, and even slow disease progression. Given this knowledge, researchers designed an exercise program for individuals with PD called PD SAFEx TM. Although this program has proven to have many physical benefits, the psychological aspects of exercise, such as motivation, have yet to be tested in PDSAFEx TM. Therefore, using Self Determination Theory as a guide, the purpose of the current project was to monitor individual changes in motivation over two time points through the exploration of individuals’ regulation of exercise behavior (e.g., external, intrinsic). To achieve this objective, 45 participants (mean age = 68.5) diagnosed with PD and enrolled in PDSAFEx TM were asked to complete the Behavioural Regulation in Exercise Questionnaire-3 prior to, and following, an intervention designed to decrease severity of motor symptoms for individuals with PD. A repeated measures MANOVA suggests that there were no significant changes in motivation after three months of exercise with respect to any of the five exercise regulations that met the reliability criteria (e.g., intrinsic regulation pretest, M = 2.78; intrinsic regulation post-test, M = 2.87). Given that there were no changes in motivation over a three month period, our discussion focuses on opportunities that exist for developing psychological interventions with the PDSAFEx TM program that would further enhance the already existing physical benefits of this program. The focus of these interventions could include, but are not limited to, psychological aspects such as motivation, efficacy beliefs, group dynamics, and barrier reduction.

Predictive interactions leading to the performance during a competition among university cross-country runners

Gosselin Boucher, Vincent, Comtois, Alain Steve, University of Quebec in Montreal

Performance during a competition among endurance athletes may be distressed by psychological parameters. The understanding and connections between them leads to adapting training and follow up of elite athletes. Thus, the purpose of this study was to identify psychological predictors of performance in a 3000m race. Distance runners from the University of Quebec in Montreal were invited to participate at a recruitment race trial to be part of the varsity cross country team. Twenty runners participated: 10 women (25.9 SD 7.0 years old; 22.2 SD 1.8 BMI) and 10 men (23.2 SD 2.4 years old; 22.6 SD 1.6 BMI). The recruitment session was during a 3000m race where two groups were formed by randomized distribution for each gender group. Before warm-up participants completed French versions of the Competitive State Anxiety Inventory (CSAI-2R), Five Facets Mindfulness Questionnaire (FFMQ) and Positive and Negative affect Schedule (PANAS). All questionnaires had excellent internal consistency (Cronbach $\alpha>0.80$). The average time for the 3000m race for men was 639.8 SD 43.3s and for women 828.9 SD 79.3s. The Pearson correlation revealed a significant positive link between self-esteem and mindfulness ($r2=0.27$; $p<0.05$) and the experience description factor ($r2=0.33$; $p<0.01$). Linear regressions (bottom-selection method) revealed differences between genders in predictive psychological factors of performance. The entire group obtained a $R2=0.656$ for post competition positive emotions, somatic anxiety and competition anxiety ($p<0.01$). The men group obtained a $R2=0.907$ that combined pre competition positive emotions, observational factors, and cognitive anxiety ($p<0.01$). The women group obtained a $R2=0.767$ for post competition positive and negative emotions ($p <0.05$). Overall, the pre-post competition emotions are good predictors of performance. The prediction of the performance was on average 78% when the competition anxiety and mindfulness of the athletes were added. In conclusion, it seems that a significant difference between sexes is present in the manner of living a competition in elite athletes.

Effects of performance feedback on affect and resistance exercise performance

Graham, Jeffrey D., Bray, Steven R., McMaster University

Self-regulation plays a critical role in sport and exercise performance (Bray et al., 2015; Hagger et al., 2010). According to Control Theory (Carver, 2015), when tasks are performed in succession, self-regulated performance is dependent upon feedback and associated affective responses. Overperformance (high feedback) and underperformance (low feedback) lead to positive and negative affective responses, respectively. In turn, high feedback/enhanced affect leads to worse performance while low feedback/reduced affect leads to better performance. The purpose of this study was to investigate the effects of feedback on affect and performance using repetitive resistance exercise. Participants ($N = 63$) performed two maximum repetition sets on each of bench press (at 60% of 1RM) and leg extension (at 40% of 1RM). The two sets of exercise were separated by a period of active rest (reading for 5 min) and a bogus normative performance feedback manipulation (high/low). Affect (Feeling Scale) was measured at baseline, subsequent to each exercise set, and following the feedback manipulation. Ratings of perceived exertion (RPE; Borg, 1998) were measured after each set. Groups performed equivalently on the first sets of exercise ($ps > .42$), reported similar affect prior to feedback ($p = .49$), and rated RPE equivalently following each set ($ps > .72$). Results showed significant group differences following feedback ($p = .002$, $d = 0.83$): affect increased following high feedback and decreased following low feedback. High feedback led to a reduction in reps on bench press ($p < .001$, $d = 0.65$) and leg extension ($p < .001$, $d = 0.46$) whereas low feedback led to an increase in reps on bench press ($p < .001$, $d = 0.54$) and leg extension ($p < .001$, $d = 0.42$). Findings are consistent with Control Theory, but are contrary to what are predicted by social cognitive theories (e.g., Bandura, 1997) and have implications for future research and practice in terms of understanding how cognitive and affective systems operate interdependently to affect performance.—Supported by a NASPSPA Research Award

A meta-analytic review of prosocial and antisocial behavior in sport

Graupensperger, Scott A., Jensen, Cjersti, Bowling Green State University

Sport participation has long been revered as a means of building character, which is an outcome that is often investigated in terms of prosocial and antisocial behavior (Kavussanu, Seal, & Phillips, 2006). While sport can be an

effective platform to instill transferrable life skills (Turnidge, Cote, & Hancock, 2014), Coakley (2011) asserts that it is a common misconception that sport participation magically builds character. Social identity theory suggests that there would exist a positive relationship between prosocial behavior towards teammates (PBT) and antisocial behavior towards opponents (ABO), as athletes often demonstrate in-group favoritism and outgroup biases (Nezlek & Smith, 2005; Sherif, 1966). That is, as athletes are more prosocial towards teammates, they are also more antisocial towards opponents. If sport participation promotes PBT as well as ABO, then it is doubtful that true character development is taking place. Conversely, social cognitive theory suggests that there should be no relationship between PBT and ABO as antisocial behavior in sport is regulated by self-conscious emotions such as guilt and empathy (Bandura, 1991; Stanger, Kavussanu, Boardley, & Ring, 2013) Because 6 past studies found a negative relationship (3 significant) between PBT and ABO, while 16 studies found a positive relationship (7 significant), a meta-analysis was imperative. Despite 10 studies finding significance, our meta-analytic compilation of the 25 extant effect sizes revealed that there exists no significant relationship between PBT and ABO, thus supporting the social cognitive theory in that ABO is effectively regulated in sport, regardless of the level of PBT. This finding suggests that sport can be a practical means of building character. Furthermore, results show positive relationships between PBT and prosocial opponent behavior, as well as between antisocial teammate behavior and ABO. Surprisingly, tests of heterogeneity were non-significant, indicating that no moderating variables (e.g., sport type) exist.

Coach characteristics and encouragement of athlete's imagery use

Gregg, Melanie J., The University of Winnipeg; Hall, Craig R., Western University

Coach education aims to enhance the delivery of sport programs through developing coach knowledge. There has been support that coaches who have completed some formal coach education program are more likely to apply coaching theory compared to coaches who have not completed formal programs. The purpose of the present study was to explore factors in addition to coach education that may influence the application of coaching theory, in particular coaches' encouragement of athletes' use of mental imagery. British coaches (N = 301) from 34 sports volunteered to participate in the study. The sample included male (n = 75.7%) and female (n = 24.3%) coaches with a mean age of 33.46 years (SD = 10.15), who had been coaching for an average of seven years (SD = 6.28). Coaches completed the Coaches' Encouragement of Athletes' Imagery Use Questionnaire (Jedlic et al., 2007). The coaches rated the extent to which they have an influence on their athletes' use of imagery on a 7-point scale with anchors of 1 = rarely and 7 = often encourage athletes to use imagery. A total of 19 coach characteristics, selected based on previous research, were assessed via a demographics questionnaire, e.g., level of coaching certification, competitive level of athletes being coached, and individual versus team sports. Using MANOVA and Roy's largest root, there was a significant multivariate effect of coach certification on encouragement of athletes' use of imagery, $\Theta = 0.04$, $F(5, 295) = 2.31$, $p = .04$. Similarly, a significant multivariate effect was identified for level of athletes coached, $\Theta = 0.10$, $F(5, 295) = 6.00$, $p < .001$. Finally, a significant multivariate effect was evident for coaches of team versus individual sports, $\Theta = 0.09$, $F(5, 295) = 5.33$, $p < .001$. Identifying characteristics that predispose coaches to implement knowledge gained from coach education programs can be used to guide these programs and target learning materials.

A comparison of public school and private school children's levels of active play

Guerrero, Michelle, University of Windsor; Tobin, Danielle, Western University; Munroe-Chandler, Krista, University of Windsor; Hall, Craig, Western University

How do factors such as academic outcomes, student characteristics, and parent characteristics differ between private and public institutions? Several studies have attempted to answer these questions. Overall, research has shown that private school students, compared to public school students, have better academic performance and are more likely to live in urban areas (Frenette & Chan, 2015). Additionally, parents of private school students tend to be better educated and also have higher household incomes than those of public school students (Van Pelt et al., 2007). What remains unanswered is whether private and public students differ on levels of physical activity, particularly active play (spontaneous, child-initiated moderate-to-vigorous physical activity). Therefore, the purpose of the present study was to compare private and public school students' levels of active play as measured by pedometers. Given that students from higher income families (Jansen et al., 2006) and from urban neighbourhoods (Holt et al., 2009)

are more likely to be physically active, it was hypothesized that private school students will have higher levels of active play than public school students. A total of 57 students (Mage =10.24 years, SD = .80) participated in the current study. Students were recruited from one private school classroom (n = 24) and one public school classroom (n = 33) in Southwestern Ontario. Students were asked to wear the pedometer for seven consecutive days (Monday through Sunday), and were asked to remove the pedometer prior to any structured activity (e.g., organized sport). One-way ANOVAs were utilized to compare school differences on weekday and weekend step counts. The results revealed no significant differences between private and public school students' weekday step count, $F(1, 55) = 1.62$, $p = .21$, nor weekend step count, $F(1, 55) = 1.23$, $p = .27$. While the findings suggest that levels of active play are similar between private and public school students, further investigations are needed to confirm these findings.—*Social Sciences and Humanities Research Council of Canada*

The impact of a multi-sport camp for girls ages 8-11 with Autism Spectrum Disorder (ASD) on motor skills, self-perceptions, social skills and adaptive behaviour

Guest, Lindsay M., Lloyd, Meghann, University of Ontario Institute of Technology (UOIT)

Children with Autism Spectrum Disorder (ASD) often demonstrate poor quality motor skills when compared to their peers; this may inhibit their ability to participate in age appropriate activities. Girls with ASD have lower quality motor skills than their peers, favouring further inactivity. Active girls tend to have greater physical self-perceptions and confidence; another dimension that promotes physical activity (PA). The purpose of this study was to determine if participation in a one-week multi-sport camp is beneficial for improving fundamental motor skills (FMS), physical self- perceptions, and adaptive behaviour of girls with ASD ages 8-11 (n=13). This study also investigated if self- reported physical self-perceptions were related to FMS. The Test of Gross Motor Functioning-2 (TGMD-2) was used to assess FMS, the Children's Self-Perceptions of Adequacy in and Predilection for Physical Activity (CSAPPA) and Children and Youth Physical Self-Perception Profile (CY-PSPP) were used to assess physical self-perceptions of PA at pre-, post- and 8-week follow up. Parents were given the Social Skills Improvement System (SSIS) and Vineland Adaptive Behaviour Scale (VABS-2) to complete at the pre- and 8-week follow up to measure social skills and adaptive behaviour. Results indicated that the camp was effective at improving FMS ($p<0.0001$), physical self-perceptions ($p=0.044$) and social skills ($p=0.005$). Significant correlations were found between FMS and physical self-perceptions ($p=0.049$), and between physical self-perceptions and social skills ($p=0.004$). The results of this study indicate that participation in a multi-sport skills camp can be effective at improving FMS, physical self-perceptions, and social skills of girls ages 8-11 with ASD; however, further research with larger samples and greater intervention intensities is necessary.—*Special Olympics Canada*

Direct, indirect and reciprocal relationships between psychological need satisfaction and physical activity in adolescents: their effect on health-related quality of life

Gunnell, Katie E., Children's Hospital of Eastern Ontario; Brunet, Jennifer, University of Ottawa; Sabiston, Catherine M., University of Toronto; Bëlanger, Mathieu, Université de Sherbrooke

The purpose of this study was to examine the associations between psychological need satisfaction (PNS) and moderate-to-vigorous physical activity (MVPA) in adolescents across a three-year period. The associations between PNS and MVPA over time were also examined as correlates of health-related quality of life (HRQoL) at the end of the third year. Starting in grade 5/6, adolescents (N = 918; Mage = 10.8 years) completed a self-report questionnaire about PNS and MVPA every four months until grade 8/9, resulting in 10 measurement points spanning three years. HRQoL was assessed at the 10th measurement point, in grade 8/9. The data were analyzed using latent curve modeling with structured residuals with a robust maximum likelihood estimator in Mplus. The model depicting reciprocal relationships between PNS and MVPA provided a good fit to the data: $MLR\chi2= 364.86(190)$, $p < .05$, CFI = .97, RMSEA = .03 90%RMSEA CI = [.03, .04]. At the within-person level, prior PNS predicted subsequent MVPA, whereas prior MVPA did not predict subsequent PNS. At the between-person level, increases over three years in MVPA ($\beta = .22$, $p < .05$) and PNS ($\beta = .27$, $p < .05$) were both directly associated with higher HRQoL at the end of the third year ($R2 = .20$). PNS in grade 5/6 was indirectly related to HRQoL through overall increases in MVPA (indirect effect = .08, 95%BcCI = [.000, .20]). Based on these results, it may be useful to increase adolescents' opportunities to satisfy psychological needs in grade 5/6 because it could lead to increases in MVPA, in turn leading to higher HRQoL.—*The MATCH study is supported by the New Brunswick Health Research*

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Can The Moblees move Canadian kids?

Gunter, Rebecca, York University; Faulkner, Guy, University of British Columbia; Tremblay, Mark, University of Ottawa; Berry, Tanya, University of Alberta; Nair, Pratik, University of Toronto; Kamarhie, Aria, York University

Background/Purpose: The Moblees is a multi-platform initiative that embraces an anti-sedentary philosophy, while attempting to give children tools to live a healthy active lifestyle. One element of The Moblees is a CBC television show designed to encourage preschoolers' healthy active living. The purpose of this study was to a) examine children's physical activity (PA) while viewing an episode of The Moblees and b) identify relationships between parents' attitudes toward the program, parents' support behaviour for their child's PA, and children's PA during the show. Method: Parents (N=104 with a child 3-6 years) completed an online questionnaire assessing perceptions regarding their child's PA and sedentary behaviour. Parents then watched The Moblees with their child and reported a) their child's experience and PA behaviour while viewing and b) perceptions of the program to influence their child's PA and TV habits' Results: The majority of the child viewers (76%) engaged in PA while viewing the show. Compared to those who did not, children who did engage in PA while viewing watched less TV overall ($F=3.9$, $p=0.05$) and received more parental encouragement for PA during the show ($F=5.5$, $p=0.02$). The strongest predictor of children's PA while viewing was parental encouragement for PA during the show (ß=.29, $p<0.01$). Conclusions: The Moblees television program may be effective for encouraging PA during viewing for preschool children. Parent encouragement for PA during the show is important in prompting children's PA. The results of this project may help inform strategies to enhance The Moblees program.—*The Centre for Healthy Active Kids*

Examining the use of punishment in youth baseball

Gurgis, Joseph, Kerr, Gretchen, University of Toronto

The purpose of this study was to examine youth athletes' experiences of punitive methods used in sport as well as athletes' responses to these experiences. The researcher participated as an assistant coach with an elite, youth baseball team over a four month period. In addition to participant observation data, semi-structured interviews were conducted with 11 male athletes, ages 13-14 years. Each athlete was asked about his previous experiences with various forms of punishment in sport administered by the coaching staff. All of the athletes reportedly experienced punishment through exercise, benching, and yelling. Of the three methods, yelling was reportedly the most detrimental because it was perceived as ineffective and belittling. Benching was reportedly disliked because it removed athletes from the game and their teammates; however, in addition to using this method as punishment, benching was interpreted by some as a means to encourage discipline and motivation, as well as a strategic tool. Finally, exercise was reportedly the most accepted form of punishment because athletes perceived this method as benefiting their physical development and sport performance. Despite athletes normalizing exercise as the ideal punishment, coaches scarcely used this tactic throughout the season. The findings have implications for young athletes' sense of self and acceptance of questionable practices in youth sport.

Efficacy and performance beliefs in athlete-athlete dyads: partner differences using the social relations model

Habeeb, Christine M., University of Stirling; Eklund, Robert C., Stirling University

Self- and collective efficacy (Bandura, 1977, 1997) have repeatedly been identified as important psychological mediators of performance. Beliefs about a specific partner's abilities (i.e., other-efficacy; Lent & Lopez, 2002) have since been posited as central to understanding the importance of social others in interdependent performance settings (Jackson, Bray, Beauchamp, & Howle, 2014). Athlete dyad members have qualitatively identified the partner as a unique source of divergent efficacies (Jackson, Knapp, & Beauchamp, 2008), but the extent to which each efficacy perception is attributable to personal tendencies (actor effect), partner characteristics (partner effect), or unique dyadic- pairings (relationship effect) has yet to be evaluated. College cheerleaders (n = 102) completed single-item measures of self-, other-, and collective efficacy and subjective performance surrounding paired-stunt tasks with a

male "base" and a female "flyer." Four tasks (2 easy, 2 hard) were performed with three different partners. Variance in ratings across partners was isolated into separate components (actor, partner, relationship, error) using the Social Relations Model (Kenny & La Voie, 1984). These components were then examined using task difficulty (easy, hard) by variance component (actor, partner, relationship, error) by role (base, flyer) RM-ANOVAs. Three-way interactions were significant for all efficacy and performance ratings, although collective perceptions were not explained by the relationship effect as expected. Across the self-, other-, and collective ratings, partner-oriented perceptions (partner effects) were associated with the athlete most dependent on the relationship (i.e., the flyer), while self-oriented perceptions (actor effects) were associated with the less dependent partner (i.e., the base). Orientations were significantly more prominent in the difficult task set. Results suggest, in addition to task difficulty, that the selection, interpretation, and processing of efficacy- and performance-relevant information may be filtered by one's role in a dyad.

Patient and practitioner perspectives of psychological need satisfaction in physical therapy

Hall, Morgan S., Podlog, Leslie William., Newton, Maria, Fritz, Julie, Galli, Nick A., Butner, Jonathan;, University of Utah

Chronic pain affects over 100 million Americans each year, with annual healthcare and lost wage costs in excess of 600 billion dollars (Gaskin & Richard, 2012; Simon, 2012). While physical therapy is commonly recommended for pain management symptoms and enhancing patient-centered outcomes (daily function), adherence to prescribed treatment programs is notoriously low (Bassett, 2003; Turk & Rudy, 1991). Prior research suggests that satisfying individuals' basic psychological needs enhances motivation (Deci & Ryan, 2000) and may influence adherence to practitioner prescribed rehabilitation regimens. The ways in which patients' needs may be satisfied, or potentially undermined by physical therapists (PTs) however, remains unclear. The purpose of the current study was to examine this issue through interviews conducted with 9 patients and 9 practitioners. Directed content analysis revealed that PTs could support or hinder psychological needs through the provision of feedback and the enactment of particular behaviors. In particular, the level of challenge when prescribing patient exercises, the type and quality of feedback, and the extent to which PTs implemented 'structure" in guiding patient progress, impacted perceptions of competence. Patient autonomy was thought to be supported or suppressed depending upon the degree to which PTs maximized choice, acknowledged patient feelings, and provided meaningful rationales. Finally, when PTs engaged in close and caring interactions, expressed authentic interest and empathy, and acknowledged patient perspectives and feelings without assigning blame or judgment, appraisals of relatedness were enhanced. Findings highlight important means by which PTs may foster patient need satisfaction. Perspectives gained in the present study may be used in the development and testing of need satisfaction inventories.

Examining barriers to engaging in physical activity across the stages of change among women undergoing chemotherapy for breast and gynecologic cancers

Hallward, Laura, Duncan, Lindsay R., McGill University

Background: Research has shown that physical activity (PA) can improve physical and psychological functioning and quality of life (QoL) during and after cancer treatment. Cancer patients undergoing treatment face unique barriers to PA which may differ as a function of their readiness to engage in PA. The purpose of this study was to examine how barriers to engaging in PA differ across the stages of change among women undergoing chemotherapy. Methods: We recruited 72 adult women (Mage=56.32, SD=12.43), within their first 2 months of treatment for breast or gynecologic cancers, from the infusion clinic of a Cancer Center prior to a chemotherapy session. Participants must not have had any health condition preventing unsupervised PA. Questionnaires assessed demographics, cancer type and treatment information, stage of change for PA (Spencer et al., 2006), QoL (Functional Assessment of Cancer Treatment; Brady et al., 1997), and barriers to engaging in PA (Courneya et al., 1999). Results: We conducted ANOVAs to determine whether the barriers to PA were experienced differently across the stages of change for PA. Individuals in the action stage reported time as a significantly less important barrier than those in the maintenance and preparation stages, $F(4, 60)=3.57$, $p=.011$. The action group reported significantly higher levels of side effects, $F(4, 60)=2.79$, $p=.034$, and discomfort, $F(94, 57)=3.46$, $p=.013$, as barriers than the pre-contemplation group. Finally, significant differences were found for feeling weak as a barrier between the action group versus pre-contemplation, contemplation, and preparation groups, $F(4, 55)=6.09$, $p<.001$. Despite

differential reports of side effects and physical symptoms as barriers to PA, no significant between-groups differences on any QoL subscales were observed. Conclusion: Women undergoing cancer treatment for breast or gynecologic cancers experience different barriers to PA depending on the stage of change for PA. These findings can provide information how to tailor PA interventions based on a patient's stage of change for PA.

Psychological climate and its relationship to social physique anxiety and self-presentational efficacy
Hamamoto, Sarah K., Desmond, Daniel, Wilson, Kathleen S., California State University, Fullerton

Group exercise classes have been identified as settings where body-related concerns might be present (Martin & Fox, 2001). Two such constructs include social physique anxiety (SPA; perceptions of negative evaluation of one's physique (Hart et al.,1989)) and self-presentational efficacy (SPE; confidence to present oneself to others (Leary & Atherton, 1986)). As these constructs may be related to feelings of safety and comfort in the group setting, one might speculate that psychological climate (PC), which reflects perceptions of meaningfulness and safety (Brown & Leigh, 1996; Spink et al., 2013) would be related to the experience of body-related concerns. The purpose of this study was to examine the relationship between PC and both SPA and SPE. University students (N=394) enrolled in a sixteen-week group-based activity courses completed a questionnaire during class time midway through the semester. The students received credit for the course, but there was no incentive for participating in the research. The questionnaire included measures of state SPA (9 items; Martin-Ginis et al., 2011) and SPE (5 items; Gammage et al., 2004). Also, PC (21 items; Spink et al., 2013) was measured with 3 safety subscales (supportive management, role clarity, and self- expression) and 2 meaningfulness subscales (contribution and challenge). Separate multiple regressions were performed with the 5 PC subscales predicting SPA and SPE. For SPA, the overall regression model was significant ($p<.001$) and PC accounted for 14.9% of variance in SPA. The PC subscales of self-expression ($b=-0.21$, $p<.001$) and challenge ($b=0.08$, $p=.001$) significantly predicted SPA. For SPE, the overall regression model was significant ($p<.001$) and PC accounted for 14.1% of the variance in SPE. Role clarity ($b=-2.79$, $p=.031$), contribution ($b=3.45$, $p<.001$), and challenge ($b=-3.88$, $p<.001$) emerged as significant predictors. This study illustrates the complexity of the relationship between psychological climate and perceptions of both social physique anxiety and self-presentational efficacy.

Differences in psychological climate based on gender and type of exercise class
Hamamoto, Sarah K., Desmond, Daniel, Wilson, Kathleen S., California State University, Fullerton

Psychological climate (PC), which is an individual's perceptions of the safety and meaningfulness of the psychological environment, has been related to effort in sport (Spink et al., 2013) and exercise settings (Hamamoto et al., 2015). PC is characterized as a multidimensional construct with subscales including role clarity, supportive management, self-expression, challenge, and contribution (Brown & Leigh, 1996). While previously examined in organizational settings (Brown & Leigh 1996), this construct has received little attention in the sport and exercise areas. One factor that may affect these perceptions of PC could be the type of the task as previous studies show that cohesion differs across class type (aerobic versus martial arts; Akpınar, Kirazcı,& Aş"ı, 2011). Another factor to consider is the individual's gender as others have described how experiences of cohesion may differ by gender (Eys et al., 2015). The purpose of this study was to examine the differences in PC based on class type and gender. Participants ($n_{female}=269$; $n_{male}=127$) were university students enrolled in either a 16-week aerobic or resistance training class for credit ($n_{aerobic}=7$, $n_{resistance}=7$). Each student completed a questionnaire during class time that assessed demographic information and PC (21 items; Spink et al, 2013). A 2(Gender)x2(Class type) Factorial MANOVA was performed with the 5 PC subscales as the dependent variables. Neither the interaction ($\lambda=.993$, $p=.726$) nor the gender main effect was significant ($\lambda=.975$, $p=.075$). However, there was a significant difference in PC for class type ($\lambda=.953$, $p=.002$). Challenge ($p<.001$) and contribution ($p=.03$) significantly differed between the aerobic vs. resistance training classes. For both challenge and contribution, more positive perceptions of PC were reported in the aerobic classes than the resistance training classes. This study suggests that different task types within a group setting may have a different influence on individuals' feelings of psychological climate, specifically meaningfulness.

Verbal and nonverbal communication of badminton coaches affect learning attitude of learner?

Han, Dong-Wook, Department of Sport Science at Chonbuk National University; Song, Seok-Hyun, You, Gyeong-Geun, Kim, Chan-Woo, Chonbuk National Universty

The aim of study is to search for the causal relationship between the badminton sports coachers' verbal & nonverbal communication and learning interesting, learning concentration, and learning self-confidence. The participants were members who were registered in badminton centers in Jeollabuk-do province, Korea and 285 samples were selected using convenience sampling method. Questionnaire used by Jeong etc. (2014) was revised. We collected data including an exploratory analysis, a Cronbach's alpha, and a linear regression analysis by using the SPSS version 22.0. The statistical significance was determined at the level of .05. Results were as follows. First, verbal & nonverbal communication of badminton sports coaches had significantly affected learning interest and learning concentration. However, learning self-confidence was not effected by communication. Second, learning self-confidence had significant effect on learning concentration and learning interest.

Relative age effects and positive youth development

Hancock, David J., Indiana University Kokomo

When properly structured, sport provides positive developmental outcomes for youth including teamwork, improved fitness, and social connections. In sport, it is common to group same-aged youth together to improve safety, competition, and fair play. This structure, however, has the potential to detract from positive youth outcomes through a phenomenon known as the relative age effect. Specifically, the relative age effect is when one's birthdate leads to participation or performance advantages over one's peers. Typically, advantages exist for relatively older athletes (i.e., those born earlier in the selection year) and are most evident in team sports that require high levels of physical skill (e.g., ice hockey and soccer). Not surprisingly, relative age effects have led to negative consequences for youth, such as relatively younger athletes dropping out of sport, not participating on elite sport teams, and having lower participation rates. Very few studies, however, have examined potential differences in athletes' in-sport experiences according to relative age. Thus, the purpose of the present study was to investigate the developmental experiences of soccer players according to relative age. The sample included 127 female athletes between the ages of 12 and 20. Athletes completed the 4Cs test package (Vierimaa et al., 2012) assessing competence, confidence, connection, and character. Chi-square analysis revealed a significant relative age effect ($\chi2(3, 126) = 9.16$, $p < .05$, $w = 0.27$) with relatively older athletes being over- represented. Next, a series of one-way ANOVAs demonstrated no significant differences between athletes' relative age and coach-rated competence, peer-rated competence, sport confidence, connection to coach, and character. This result aligns with previous research (e.g., Baker et al., 2010) showing no discrimination of relatively younger athletes once selected to elite teams. The discussion centers around coaches' influences on the relative age effect, as well as other social agents who might have a larger impact on the effect.

Size versus density when examining birthplace effects

Hancock, David J., Indiana University Kokomo; Coutinho, Patricia, University of Porto; Cote, Jean, Queen's University; Mequita, Isabel, University of Porto

The birthplace effect is when being born in certain city sizes increases the likelihood of participation and attaining elite sport status. Previous studies noted that small cities are most conducive for talent development (Cote et al., 2006), likely due to social and environmental features of smaller cities (e.g., relationships, green space, safety). Past research focused on city size, rather than density, which might be a more accurate depiction of cities' internal structures. Toronto (Canada) and Porto (Portugal), for instance, have the same population density, but Toronto's population is approximately four times greater than Porto. The purpose of this study was to investigate how two indicators of birthplace effects total population and density, affect the likelihood of becoming an elite volleyball player in Portugal. Participants included 4062 adult male and female volleyball players, who played First, Second, or Third League in Portugal. We created five district size categories (Portuguese districts are akin to North American cities) based on participants' birthplace to examine if being born in certain district sizes or of certain population density increased the likelihood of volleyball expertise. For all participants, being born in a district of 200,000 to 399,999 people doubled the chances of volleyball expertise, while all other districts decreased those

odds. Additionally, there was a significant negative correlation between population density and volleyball status for male players (as density increased, expertise decreased), but no relationship for female players. Discussion centers on the implications of these findings, as well as the different methods for assessing birthplace effects.

Perceptions of competition under zero-sum and within-group conditions in a motor-task game

Harenberg, Sebastian, McCaffrey, Rob, University of Regina; Fitzgerald, Ryan, University of Portsmouth; Evans, M. Blair, The Pennsylvania State University; Willfong, Fleesha, Moisondz, Kyla, Michaud, Celia, University of Regina

Several hundreds of studies have examined the outcomes of competition on productivity and other psychological factors (Murayama & Elliot, 2012). However, Kilduff et al. (2010) noted that the conditions competition occurs within are less frequently studied, even though they may be vital to understanding when competition promotes (or thwarts) important motivational and performance outcomes. The current study was specifically conducted to contrast within-group competition (i.e., between teammates for the right to represent the team) with zero-sum competition (i.e., only one winner). We expected participants to perceive more enjoyment and willingness to cooperate with competitors as well as less determination to win and perceived challenge when competing under within-group conditions. Participants were recruited from an undergraduate sport psychology class. The recruited students were invited to bring two friends to the experiment. In total 48 groups of friends (N=144) participated. The groups were randomly assigned to zero-sum or within-group competitive conditions. The participants completed a competitive motor-task game followed by questionnaires measuring task enjoyment, perceived challenge, determination to win, and willingness to cooperate with competitors. Independent samples t-tests were conducted to contrast the two experimental groups. Confirming our hypotheses, participants competing within groups perceived the competition as less challenging ($t(142)=-2.43$, $p<.05$, $d=.34$) and were less determined to win ($t(142)=-2.04$, $p<.05$, $d=.41$). An explanation may be that even if within-group competitors lose, they may still perceive a possibility of an overall favourable outcome (e.g., winning against another team). Surprisingly, participants reported also lower willingness to cooperate ($t(142)=-2.19$, $p<.05$, $d=.35$) with competitors under within-group conditions. It is possible that aspects of the group relationship (e.g., friendship quality) played a role in the participants' perceptions. Further research directions and limitations are discussed.

The relationship between intolerance of uncertainty, competitive trait anxiety, and pre-competitive emotions in CIS female soccer athletes

Harenberg, Sebastian, University of Regina; Wolf, Svenja A., University of Amsterdam; McCaffrey, Rob, Carleton, R. Nicholas, University of Regina

Competitive trait anxiety has been linked with impaired competitive performance; nevertheless, relatively little attention has been invested in understanding dispositional characteristics that may magnify anxious responses to competitive situations in sports. For example, substantial research evidence from clinical psychology suggests that Intolerance of Uncertainty (IU, the tendency to consider the possibility of a negative event occurring as unacceptable and threatening, irrespective of the probability of its occurrence; Carleton et al., 2007) underlies several anxiety disorders (Carleton et al., 2012). However, IU is relatively underexplored in the context of sports. The current study examined the relationship between IU, performance anxiety, and pre-competitive emotions. A total of 126 female soccer athletes (Mage= 19.52, SD=1.99) completed an adapted version of the Intolerance of Uncertainty Scale (Carleton et al., 2007) and the Sport Anxiety Scale-2 (Smith et al., 2006) 24 hours prior to a competition. The athletes also completed selected subscales of the Sport Emotion Questionnaire (Jones et al., 2005) prior to the same competition (<90 minutes). Pearson correlations were calculated to examine the construct inter-relationships. The results indicated positive relationships between the inhibitory dimension of IU, all dimensions of competitive trait anxiety ($r=.24$-$.40$), and pre-game anxiety ($r=.19$). In contrast, the prospective dimension of IU was only associated with pre-game anxiety ($r=.28$). Sport competition inherently entails elements of uncertainty. The current results indicate that athletes who find uncertainty problematic may experience greater trait and pre-game anxiety, which could reasonably impact performance. Accordingly, IU should be considered a potentially problematic predisposition (e.g., by clinical sport psychologists, coaches) when mentally preparing athletes for pending competitions. Limitations and direction for future research directions are discussed.

All for one, but not one for all? Positional competition and cohesion in interdependent sport teams

Harenberg, Sebastian, Riemer, Harold A., Karreman, Erwin, Dorsch, Kim D., University of Regina; Paradis, Kyle, Western University; Martin, Luc, Queen's University

Elite sport teams usually consist of more players than available positions. Consequently, athletes have to compete for available playing time. Harenberg et al. (2015) defined this on-going and selective process as positional competition (i.e., teammates vying for the same, limited playing time in a position under the awareness of the coach). Previous research indicated positional competition to be linked to lower team conflict (Harenberg et al., 2015). However, its association with another important construct (i.e., cohesion) remains in question. As such, the current study examines the relationship between positional competition and cohesion in interdependent university team-sport athletes. Seven hundred and thirty-nine athletes (female n = 361, Mage = 20.29, SD = 1.96) completed the Positional Competition in Team Sport Questionnaire (Harenberg et al., 2014) and the Group Environment Questionnaire (Carron et al., 1985). Four multiple regression analyses with the dimensions of cohesion as the dependent variables and the dimensions of positional competition as predictors were conducted. The analyses revealed that greater variance from the task dimensions (Attraction to Group Task R2 = .25, p < .001, Group Integration Task R2 = .18, p < .001) than the social dimensions (Attraction to Group - Social R2 = .07, p < .001, Group Integration - Social R2 = .09, p < .001) of cohesion were explained by positional competition. The strongest positive predictors of the task cohesion dimensions were the communication of selection by the coach and the perceived push by teammates. The findings indicated that positional competition shared a positive relationship with task cohesion, largely dependent on the communication by the coach and the perceived performance push by teammates. The findings imply that coaches need to pay particular attention to the composition of positional competition and create transparency for players in their distribution of playing time. Limitations and future research directions are discussed.

Understanding important strategies of facilitating high program quality in one female youth physical activity mentoring program

Harlow, Meghan, York University; Bean, Corliss, Forneris, Tanya, University of Ottawa

Youth programming is critical for youth across North America, as research has indicated that more than 86% of youth in Canada and 57% of youth in the United States participate in at least one organized extra-curricular activity. Within the literature, the importance of delivering a high quality program, such as a physical activity-based mentoring program, has been recognized as a key predictor of psychosocial development in youth. As this context has shown to be an important avenue for youth development, it is necessary to understand features that enhance the quality of such programs. The purpose of this research was to explore participants' perceptions of how program quality was facilitated in one in-school mentoring program for female youth. The program ran once per week for 1 hour in length over the school lunch hour for a 3-month period. Upon program completion, semi- structured interviews were conducted with eight youth participants and two program leaders that explored youth's perceptions of the program climate and leaders' insight into strategies and challenges related to facilitating the program. A deductive thematic analysis was employed using the Youth Program Quality Assessment's domains (High/Scope Educational Research Foundation, 2005). Results indicated that program leaders were successful in providing a Safe and Supportive Environment, as well as opportunities for youth Interaction and Engagement. These findings offer support for recent literature outlining that when programs encompass all four of these features, high program quality is achieved, and as such, youth participants are more likely to experience positive developmental outcomes. Practical implications and areas for future research are discussed.

Is sport unique: A comparative study of high school extracurricular activities

Hawvermale, Erica, Dorsch, Travis E., Utah State University

Extant research has linked high psychological sense of community (PSOC) in adolescence to adaptive outcomes such as enhanced motivation, self-efficacy, and ability to cope with major life transitions (Baumeister & Leary, 2014; Compas et al., 2005; Henry & Slater 2007; Vieno et al., 2005). High PSOC is also associated with reduced stress, anxiety, and depression, as well as reduced likelihood of gang involvement (Battistch & Hom, 1997; Baumeister & Leary, 2014; Royal & Rossi, 1996). In light of these findings, the present study was designed to

analyze the relationship between high school students' participation in extracurricular activities and their perceptions of PSOC. Participants (N = 701) were 276 males and 425 females (Mage = 16.51; SD = 1.16) who were actively engaged in competitive (e.g., sports; n = 218), performance (e.g., music; n = 370), and participatory (e.g., clubs; n = 113) activities in high school. Students responded to survey items assessing their enjoyment of and commitment to the activity, and their perceived sense of community. MANOVAs revealed significantly lower reports of enjoyment and motivation among students participating in performance groups than among students participating in competitive and participatory groups. Group difference tests also revealed higher perceptions of sense of community among students in competitive and participatory groups than students in performance groups. Follow-up qualitative focus groups with participants suggest that students in performance groups may experience lower enjoyment, commitment, and sense of community due to the compulsory nature of activities such as band, choir, and orchestra in high school. This research illuminates the potential benefits of autonomous participation in competitive and participatory activities in high school, and suggests that PSOC may be an underlying mechanism enhancing the potential for students to experience positive developmental outcomes from their participation.—*Utah State University Office of Research and Graduate Studies*

Elite athletes do not outperform recreational athletes in non-sports-specific cognitive measures of processing speed, memory span, letter readout speed and sustained attention

Heppe, Holger, Fleddermann, Marie-Therese, Kohler, Axel, Zentgraf, Karen, University of Muenster

Several studies support the idea of a positive relationship between non-sports-specific cognitive skills and sports expertise for dynamic divided attention (Faubert, 2013), executive functioning (Verburgh et al., 2014; Vestberg et al., 2012) and visuo-spatial attention (Alves et al., 2013). In their meta-analysis, Voss et al. (2010) found that athletes from strategic sports (such as soccer or volleyball) showed smaller benefits in cognitive performance than athletes from interceptive sports. But there are also findings which speak against superior cognitive skills of athletes (McAuliffe, 2004; Memmert et al., 2009; Starkes, 1987). This experiment investigated whether elite athletes differ from recreational athletes in standardized cognitive tests on processing speed, memory span, letter readout speed, and sustained attention. Elite athletes (n = 26, 13 females) playing volleyball on top national level or competitive soccer and recreational athletes (n = 26, 11 females) performed three cognitive tests: (1) A German version of the Trail Making Test to measure information processing speed, (2) the d2-R-Test, a paper-and-pencil test to measure sustained attention and (3) the KAI-N, which measures memory span and letter readout speed. A repeated-measures ANOVA with three cognitive tests and two groups showed no significant main effect of group, $F(1,48) = 3.641$, $p = .062$, $\eta 2 = .071$, and a non-significant interaction between cognitive test and group, $F(2,96) = 2.611$, $p = .10$, $\eta 2 = .052$. Expertise differences could not explain a significant amount of variance in cognitive functioning, which is contradictory to some findings. Most previous findings revealed the largest differences between elite players and people who did not exercise on a regular basis and smaller differences between elite and semi-elite athletes (Faubert, 2013; Verburgh, 2014). In this study, almost all participants of the control group reported to be physically active on a regular basis, which could explain why we did not find significant differences.

Elite athletes perform better in a 2-choice reaction time test, but not in mental rotation

Heppe, Holger, Kohler, Axel, Zentgraf, Karen, University of Muenster

In their meta-analysis, Voss et al. (2010) showed that cognitive skills can be transferred from the sports-specific to the general context, but they included no studies on spatial cognition. There are findings that show higher mental rotation (MR) speed for athletes with frequent overhead experience (but only for laterality, not for same- different decisions; Steggemann et al., 2011). Jansen et al. (2012) did not find this advantage for soccer players, but they only used a same-different MR test. To investigate whether these findings are grounded on decision or sports type, team sports athletes solved MR tasks requiring laterality decisions. Elite athletes (n = 27) playing competitive volleyball or handball and recreational athletes (n = 27) solved three- dimensional (3D) MR tasks with human stimuli. Participants had to decide as quickly and correctly as possible whether a ball is held in the right or left hand. A repeated measures ANOVA with factors angle disparity (60", 120", 180"), axis (depth and longitudinal) and group was conducted. The main effect of group ($F(1,52) = 0.537$, $p = .467$, $\eta 2 = .01$) and the interactions between disparity and group ($F(2,104) = 1.709$, $p = .186$, $\eta 2 = .032$) and axis and group ($F(1,52) = 3.447$, $p = .069$, $\eta 2 = .062$) were not significant. A significant 3-way interaction was found between axis, disparity and group ($F(2,104) = 4.320$, $p = .032$,

η2 = .077), which was grounded on shorter response times of elite athletes at 60" (p = .015) when rotated around the depth axis. There was also a significant difference (p = .026) in response times at 0" between elite athletes (M = 592.5, SD = 77.8) and recreational athletes (M = 648.9, SD = 101.9). Elite athletes showed only better 2-choice reaction time performance (this is measured at 0" and has impact on 60"). Despite using other stimuli (3D and laterality decisions required), this experiment replicated the findings of Jansen et al. (2012). Thus, we assume a general advantage of team sports athletes in choice reaction time tests, but not in MR.

Examining the dynamic nature of connectedness, and its relation to moral behaviour through sociometry and observation in youth sport

Herbison, Jordan, Vierimaa, Matthew, Cote, Jean, Martin, Luc J., Queen's University

Positive youth development (PYD) is an asset-oriented approach to adolescent development (Lerner et al., 2005). Specific to sport, Cote and colleagues (2010) have adapted a conceptualization of PYD comprised of competence, confidence, connection, and character (i.e., the 4Cs). Although PYD has garnered substantial research attention in youth sport (Jones et al., 2011), much of this work has introduced the Cs as collective outcomes, with little attention to their stability or interrelationships over time. Related evidence from educational settings indicates that youth's peer group nominations (i.e., connection) can fluctuate significantly over several months, a similar time frame of a youth sport season (Newcomb & Bukowski, 1984). Thus, the current project sought to explore the dynamic nature of peer group nominations (i.e., connection) through sociometry over the course of an athletic season. In addition, the relationship between peer group nominations and observed moral behaviour (i.e., character) was assessed. A youth volleyball organization composed of six competitive teams (N = 43; Female = 81.4%; Mage = 15.9; SD = 1.2) completed an adapted version of Coie et al.'s (1982) peer nomination questionnaire at the beginning and end of the season. Later in the season, a practice session was videotaped and the Athlete Behaviour Coding System (Vierimaa & Cote, 2016) was used to code the frequency of pro-social and anti-social athlete behaviour. Profile Analysis revealed a significant change in sociometric status group profiles from the beginning to the end of the season. Furthermore, athlete social impact within the team at the beginning of the season was significantly related to observed pro-social behaviour at the end of the season. Results will be presented in greater detail; however, the findings largely highlight the dynamic nature of peer groups in youth sport, with coaching implications regarding teammate interactions specifically, and the social environment more generally.

Cohesion, psychological needs, and intrinsic motivation in youth team sport context

Heuze, Jean-Philippe, Universite Grenoble Alpes; Eys, Mark A., Wilfrid Laurier University; Dubuc, Martin, Cambrian College; Bosselut, Gregoire, Universite de Montpellier; Couture, Roger, Laurentian University

Within the framework of Self-Determination Theory (SDT), the purpose of the present study was to examine adolescents' perceptions of cohesion in relation with psychological need satisfaction and intrinsic motivation through a cross-sectional design. Although several investigations have already supported different links between cohesion and the various components of SDT, some limitations prevent a fuller understanding of the role that cohesion plays with respect to individual motivation for sport participation. Specifically, limitations include inconsistent measurement and/or reporting of key SDT constructs across the studies, as well as a narrow focus on task cohesion (and not social cohesion), young adult samples, and sport type (i.e., elite soccer players). Our study included Canadian youth participants (N = 315; Mage = 15.48) from 24 different sports who responded to questionnaires designed to assess their perceptions of task and social cohesion; psychological need satisfaction for autonomy, competence, and relatedness; and intrinsic motivation. Structural equation models revealed that task cohesion was positively related to perceptions of relatedness (beta = .43, p < .001) and autonomy (beta = .24, p < .05) needs satisfaction. Moreover, greater perceived social cohesion was related to higher levels of autonomy (beta = .40, p < .001) and relatedness (beta = .35, p < .01) needs satisfaction, but lower levels of competence need satisfaction (beta = -.23, p < .05). Further, the more related (beta = .48, p < .001) players felt, the more intrinsically motivated they were. In this model, task and social cohesion explained 33.6% and 52.5% of the variance in autonomy and relatedness needs satisfaction, respectively, whereas relatedness need satisfaction explained 37.7% of the variance in intrinsic motivation. This work underlines the relevance of cohesion as a variable to be considered within the broad SDT framework. It also emphasizes the importance of social connections for youth athletes with respect to motivational processes.

Relationship between cohesion and different types of motivation in African players

Heuze, Jean-Philippe, Universite Grenoble Alpes; Diatta, Safietou, Universite Gaston Berger; Sarrazin, Philippe, Universite Grenoble Alpes

The purpose of the study was to examine the relationships between the dimensions of cohesion and autonomous motivation, controlled motivation, and amotivation advanced by the Self-Determination Theory (SDT) through a cross-sectional design. Although previous studies have investigated cohesion in relation with self-determined motivation or different types of motivation postulated in the SDT framework, they were limited by their operationalization of the constructs (global measure vs. limited facet of the constructs), the statistical analyses performed (correlation between dimensions), or their samples (North-American students). Our study included 360 Senegalese Francophone players (271 men, 89 women; mean age = 23.44 years) involved in the two highest levels of play in one of the five most popular team sports in Senegal (i.e., basketball, soccer, handball, rugby, volleyball) were enrolled in the study. After informed consent was obtained, the participants completed the French versions of the Group Environment Questionnaire and the revised Sport Motivation Scale. A structural equation modelling controlling for gender and status (i.e., professional vs. amateur) indicated that individual attractions to the group-task negatively predicted controlled motivation (beta = -.35, $p < .001$) and amotivation (beta = -.44, $p < .001$). The results also revealed that group integration-task positively predicted autonomous motivation (beta = .36, $p < .001$) and controlled motivation (beta = .16, $p < .05$), but negatively predicted amotivation (beta = -.25, $p < .001$). This study underlines the necessity to consider the different dimensions of task cohesion when the cohesion-motivation relationship is examined because they are not related to autonomous motivation and controlled motivation in the same way. This pattern of results could be explained by the organismic integration theory and the cognitive evaluation theory developed in the SDT framework.

Short bouts of physical activity increase time on-task in a classroom of children with disabilities.

Hibbs, Natalyn, Lloyd, Meghann, University of Ontario Institute of Ottawa

Children with disabilities often experience challenges staying on-task during instructional time in a classroom which is why this is an important area of study for teachers and researchers. Physical activity (PA) has been shown to have a positive impact on classroom behavior. Participants of this study included 4-5 year old children with disabilities (n=14) from a special school operating under Section 68 of the Education Act where intensive early intervention classrooms are located in an children's treatment center where children receive therapy. The purpose of this study was to measure the effectiveness of PA at increasing on-task behavior in class following an active break. Baseline measurement consisted of videotaping recording student classroom behavior for 20 minutes, 4x/day for one week. During the intervention phase student behavior was videotaped for 10 minutes, followed by a 5 min activity break, and 10 minutes after the break 4x/day, 5 days/week for 4 weeks. The 5 min activity break consisted of moderate exercise to music. The follow-up week consisted of a videotape recording student classroom behavior for 20 minutes 4x/day for one week again. Student on-task behaviors were coded in 30 second intervals and summed. Results indicated there was a 5.27% positive increase change in on-task behavior after the DPA compared to before the DPA. From baseline to follow-up there was a 7.73% positive increase change in on-task behavior. These results suggest that 5 minute bouts of physical activity 4x/day may be generally effective for this population.

Can a virtual partner be a real teammate? Group and team perceptions in an exergame intervention

Hill, Christopher R., Ede, Alison, Samendinger, Stephen, Winn, Brian, Pivarnik, James M., Michigan State University; Ploutz-Snyder, Lori, Universities Space Research Association; Feltz (PI), Deborah L., Michigan State University

Exercise videogames have been marketed as a way to increase people's motivation and enjoyment to exercise by being entertaining and allowing interactions with other players. Exercising with a software generated (SG) partner over a period of time may create a sense of social connectedness with the virtual character. Over long- term exergame play, there may need to be a sense of social connectedness to stay engaged. The Media Equation (Reeves & Nass, 1996) suggests people treat virtual partners as if they are real people and interact with media in a natural, social manner. However, early research examining SG partners has not been tested longitudinally. The purpose of this study was to examine changes in social connectedness to an SG partner and team perceptions over a 24- week

exergame intervention. Participants were 16 physically active adults (8 males) aged 35 to 60. Participants engaged in a cycle ergometer exergame for 30 min, 6 days a week for 24 weeks. Participants alternated between continuous and interval cycling days and were told they were working toward a shared goal with an SG partner with whom they rode virtually. Social connectedness (Brown et al., 1986) and team perceptions (Nass, Fogg, & Moon, 1996) were measured after Week 1 with the partner (T1), at the midpoint of participation (T2), and at the conclusion of the 24 week protocol (T3). A repeated measures ANOVA was conducted to detect changes in social connectedness and team perceptions over the course of the study. Team perceptions decreased from T1 ($M = 7.16$) to T2 ($M = 4.90$), but increased from T2 to T3 ($M = 5.26$), $F(2, 15) = 6.11$, $p < .05$. Participants' perceptions of social connectedness did not statistically differ across time points (T1 $M = 3.66$; T2 $M = 2.97$;T3 $M = 3.08$), $F(2,15) = 1.27$, $p > .05$. Throughout the duration of the study, participants felt they were part of a team and were socially connected with the SG partner as indicated by ratings above the scale midpoint. Perceptions may have been inflated at the beginning of the program prior to working out with the SG partner over time.

Like me or not, I'm here to win: An examination of peer acceptance in sport

Hill MacEachern, Kate, Jorgenson, Cecilia, Stanul, Madison, Bowker, Anne, Carleton University

The sport context represents an important social environment for youth. Peer relationships in sports play a role in the enjoyment, value (Cox & Ullrich-French, 2010), self-esteem (Daniels & Leaper, 2006) and motivation (Smith, 1999) of young athletes. Of interest to the present study are the characteristics within a sport environment that may influence team acceptance and positive psychological outcomes. Achievement motivation is one such characteristic and has been conceptualized as an athlete's level of competitive (desire for success in competitive situations), win (desire for success over others), and goal (desire to achieve personal goals) orientation (Gill & Deeter, 1988). To assess the association between team acceptance and self-esteem, depressive symptoms, and enjoyment, as well as, the moderating role of achievement motivation, $N = 93$ female adolescent athletes completed a series of self-report measures. Results of linear regression analyses found that an increase in team acceptance corresponded to a significant increase in self-esteem scores ($R2 = .237$; $F (89) = 8.908$, $p<.001$) and a significant decrease in depressive symptoms ($R2 = .114$; $F (89) = 11.467$, $p<.01$). A test of the moderating role of achievement motivation found a significant effect of win orientation on the association between team acceptance and self-esteem ($t(89) = -2.345$, $p<.05$), and between team acceptance and enjoyment ($t(89) = -2.479$, $p<.05$). A simple slopes analysis indicated that team acceptance was significantly positively associated with self-esteem at low levels of win orientation ($t(89) = 4.037$; $B = .585$, $SE = .145$, $p<.001$) but not at high levels of win orientation. Furthermore, team acceptance was found to be significantly positively associated with enjoyment at low levels of win orientation ($t(89) = 2.859$; $B = .461$, $SE = .161$, $p<.05$) but, again, not at high levels of win orientation. The results of this study demonstrate the importance of team acceptance to psychological outcomes of adolescent athletes and how sport specific factors can play a role in that association.

The effect of computer-based cognitive training on the lacrosse shooting performance

Hirao, Takahiro, Masaki, Hiroaki, Waseda University

In lacrosse, shooting in the opposite direction of a goalie's movement is an effective strategy to score considering the narrowness of the goal (1.83 m " 1.83 m). However, shooting in the opposite direction is difficult and results in delayed reaction because of the spatial incompatibility. On the other hand, in laboratory-based psychological research, a reversal of the incompatibility effect has been reported after a great deal of practice, showing shorter response times on incompatible trials than on compatible trials. Performing more than 1800 trials of a stimulus-response compatibility (SRC) task resulted in a reversal of the Simon effect (Procter & Lu., 1999). Given this psychological finding, it is reasonable to assume that the shooting skill of lacrosse players could be trained by an excessive exposure to an SRC task. We hypothesized that shooters who received the SRC training would learn to shoot in the opposite direction of the goalie's movement and score more goals compared to the control group (performing a 2-back memory task). We tested twenty-nine female lacrosse players. They were split into either the SRC training group or the 2-back task training group. During the training phase, they each received 10 training sessions within four consecutive weeks. We compared shooting tests that were conducted before and after the training where participants performed 10 overhand shots (from 7 m away) to a goal that was guarded by a goalie. Results indicated that the SRC group learned to shoot to the opposite side of the goalie's movement more frequently

than the control group, although the number of successes (goals) did not significantly differ between groups. We propose that repetition of the SRC task may enhance a strategy of attentional allocation to the opposite side of a goalie's movement, and thus computer-based cognitive training combined with physical training might be beneficial for the improvement of scoring ability in lacrosse.

Exploring protégés' experiences in peer athlete mentoring relationships

Hoffmann, Matt D., Loughead, Todd M., University of Windsor; Bloom, Gordon A., McGill University

Mentoring is a process whereby a more experienced role model (the mentor) provides guidance to a developing individual (the protégé), and supports this person's development (Weaver & Chelladurai, 1999). Mentoring relationships have been studied extensively in organizational contexts where research has shown that mentoring is associated with numerous correlates including protégé performance, motivation, and sense of affiliation (Eby et al., 2013). In comparison the area of mentoring in sport is much less developed, though recent research has shown that being peer mentored by another athlete is related to enhanced satisfaction (Hoffmann & Loughead, 2015). Despite this finding, our knowledge pertaining to the nature of peer athlete mentoring remains limited. Thus, the purpose of the present study was to gain an in-depth understanding of protégé experiences in peer athlete mentoring relationships. Individual semi-structured interviews were conducted with 14 athletes (7 males, 7 females; Mage = 26.36 years) who competed at elite levels (e.g., Olympics) and who self-identified as having been peer mentored by other athletes. Interviews were transcribed verbatim and organized into themes and subthemes using a hierarchical content analysis (C"t" et al., 1993; Sparkes & Smith, 2014). Results from the analysis revealed that protégé were confident, felt they performed better, and were willing to serve as mentors themselves as a result of their mentoring relationships. Protégé's also noted that their relationships with their mentors developed slowly, progressed rapidly and were most beneficial during the middle stages, and eventually were redefined as friendships. Finally, protégé highlighted several barriers that prevented the formation or maintenance of mentoring relationships including competition amongst athletes, mentor willingness, protégé willingness, proximity of mentors, and presence of mentors. The results suggest that mentoring relationships between athletes are valuable to protégé yet may take time to prosper and may be affected by specific barriers.—*Social Sciences and Humanities Research Council of Canada*

Intergenerational change in active free play among families in rural and urban areas

Holt, Nick l., Neely, Kacey C., Pynn, Shannon, Ingstrup, Meghan, Spence, John C., Carson, Val, Robinson, Zac, deBeaudrap, Hayley, University of Alberta

Active Free Play (AFP) has declined in many developed countries over past generations. The purpose of this study was to examine intergenerational change in AFP among families who lived in rural and urban areas, along with their suggestions for facilitating AFP in the future. A total of 95 participants (37 children, 30 parents, and 28 grandparents) representing 14 families from rural areas and 14 families from urban areas participated in this study. Each participant completed one individual semi-structured interview, which was transcribed verbatim and subjected to a thematic analysis procedure. Data from families in rural and urban areas were compared and contrasted. Results showed grandparents and parents (from both rural and urban areas) recalled little regulation of their childhood play, having siblings and other children to play with, and playing imaginative games with materials they found outdoors. In contrast, children had rules and boundaries that constrained AFP to their backyards or playgrounds. Supervision was a common requirement due to parents' safety concerns. Few children mentioned having other children to play with. Children's opportunities to engage in AFP were further constrained by the time they spent using electronic devices and their enrolment in extra-curricular activities. Among participants in rural areas, suggestions for facilitating AFP involved taking children to local parks and green spaces, adults joining their children in AFP, and sparking imaginative play. In urban areas, establishing rules and boundaries to create safe play areas and getting to know neighbours so there are "eyes on the streets" were important suggestions. Overall, findings supported previous research showing parents have a critical role in constraining " and potentially facilitating " AFP. Findings further suggest interventions should be tailored to families living in rural versus urban areas because, while the barriers were consistent, facilitators of AFP varied by the communities in which the participants resided.

Differential effects of Assisted Cycling Therapy (ACT) on short-term and working memory of adolescents with Down syndrome

Holzapfel, Simon D., Ringenbach, Shannon D., Mulvey, Genna M., Sandoval-Menendez, Amber M., Birchfield, Natasha, Tahiliani, Shreja R., Arizona State University

Persons with Down syndrome (DS) suffer from prefrontal cortex dysfunction and pervasive deficits in executive functions, short-term memory, and working memory. The current study examined the effects Assisted Cycling Therapy (ACT) on short-term and working memory in adolescents with DS. During ACT, the cadence of participants on a stationary bicycle is augmented with the help of an electrical motor. Participants completed eight weeks of ACT (n = 17), eight weeks of voluntary cycling at their own preferred cadence (n = 16), or eight weeks of no cycling (n = 11). Participants in the ACT group cycled at the same heart rates but an 80% greater cadence than participants in the VC group. The forward (i.e., short-term memory) and backwards digit span test (i.e., working memory) were administered before and after the interventions. Short-term memory did not improve in any group ($p \geq 0.149$) and working memory improved only in the ACT group (Hedge's $g = 1.66$; $p = 0.003$). The results suggest that assisted high cadence cycling (i.e., ACT) produces superior neural benefits in the dorsolateral prefrontal cortex and leads to greater improvements in visuo-spatial sketchpad abilities compared to voluntary cycling and no cycling in adolescents with DS.—*NICHD*

Examining affective, cognitive, and behavioral body image predictors of media consumption habits

Howe, Holly, Ashdown-Franks, Garcia, Sabiston, Catherine M., Aheadi, Afshin, Welsh, Tim N., University of Toronto

The purpose of this study was to examine body image factors as predictors of physique-salient media consumption. Men and women (n=59) were exposed to same-sex ideal and normal physique images while completing a secondary experiment and completed a self- report questionnaire. In regression models controlling for gender, dispositional body envy (β=.32, p=.02) and body appreciation (β=-.27, p=.05) were significant predictors of the number of times participants glanced at the ideal-physique image. There was no association between physical self-discrepancy, or weekly minutes of MVPA, and viewing patterns. Pre-post assessment of affect demonstrated that participants reported lower positive affect post- experiment. Based on these findings, individuals who appreciate their bodies avoid ideal physique images, while body-envious individuals seek out these images. Affect was reduced regardless of physique-salient image consumption. These results provide experimental evidence that body image factors influence how individuals consume media, but future study is needed to determine if these changes in media consumption are protective.—*Internal Kinesiology & Physical Education*

Self-presentation on the dance floor: Self-presentation motives and outcome perceptions may predict positive feeling states

Howle, Timothy C., Jackson, Ben, Dimmock, James A., University of Western Australia

In physical activity research, self-presentation desires have often been linked to negative feeling states and affective experiences (e.g., anxiety). In this study, we considered whether there was support for the inverse position that self-presentational processes might align with positive feeling states. Undergraduate kinesiology students (N = 124) were requested to complete questionnaire measures prior to and following mixed-sex ballroom dancing classes. Using path analysis with the Bayesian estimator, we specified predictive pathways from 2 x 2 self-presentation motives and perceived self- presentational outcomes (i.e., individuals' perceptions of social approval or disapproval) in predicting positive affect and feelings of pride. The model was observed to be an excellent fit to the data; it reached convergence immediately, the chi-square difference confidence interval included zero (i.e., 95% CI -17.69, 9.86), and the posterior predictive p-value was .500. Controlling for pre-class levels of pride and positive affect, the results indicated that acquisitive self-presentation motives (i.e., drives to gain social approval) and perceptions of self-presentational success may promote positive feeling states. Conversely, protective self- presentation motives (i.e., drives to avoid social disapproval) and perceptions of self-presentational failure may inhibit these positive feeling states. The results highlight the merits of a differentiated approach to self-presentation motivation and the importance of considering motivation (i.e., what individuals want from their physical activity) alongside and independently from "gains" (i.e., what individuals achieve from their physical activity). We endorse research that

can provide further insight into the role of self-presentation in shaping both positive and negative physical activity experiences.

A systematic review of physical activity interventions for caregivers: Effects on caregivers' and care recipients' reported outcomes

Hutt, Eric A., Lambert, Sylvie N/A., Duncan, Lindsay R., McGill University

Caregiving for someone with a chronic illness can have detrimental effects on individuals' psychosocial and physical well-being. An important task in health research is to find effective ways to prepare caregivers both psychologically and physically for their demanding role and mitigate burden. To review the evidence on the effects of physical activity (PA) interventions on the reported outcomes for caregivers and their care recipients. A systematic review of experimental studies in which the impact of PA interventions on caregivers and care recipients (if measured) was conducted. Studies were primarily identified through searching six major electronic databases. Data were extracted and summarized for target population, type of interventions, outcomes, and methodological quality, following the PRISMA checklist. For studies involving a control or comparison condition, effect sizes were calculated and compared. Fourteen studies met the inclusion criteria and were reviewed. PA interventions were mainly group-based yoga programs and significantly decreased caregivers' depression, stress, distress (d = 1.2), and anxiety. Improvements were also found in regards to well-being, quality of life, sleep quality (d = 0.31 " 0.71), PA levels (d = 0.34 " 1.9), and both caregiving and exercise self-efficacy. Inconsistent effects between studies were noted for physical outcomes, such as body mass index, functional capacity, and blood pressure. Overall, few consistent improvements to physical outcomes were noted. PA interventions hold promise to improve caregivers' outcomes, and the findings of this review suggest that health care providers include caregivers as potential recipients of such programs. Despite many studies finding improved levels of PA, there were no significant physical health improvements in most reviewed studies. However, studies reviewed had small sample sizes, and more high-quality trials are needed before definitive conclusions can be drawn about the effectiveness of PA interventions for caregivers.

The effect of behavioral and cognitive routine on taekwondo skill

Hwang, Byeong-Rok, Korea Sport University; Chang, Duksun, Korea National Sport University

The practice of routine has been studied as a psychological skill training to lower competitive anxiety and enhance athletic performance, however not much research has conducted for taekwondo performance. Thus the purpose of this study was to examine the effect of behavior and cognitive routine on state anxiety and a taekwondo board breaking performance. Fourteen members of a college Taekwondo demonstration team were recruited and divided into an experiment group (n=7) and a control group (n=7). The routine program consisted of behavior and cognitive routine had four sections: pre-entrance, preparation, practice, and finishing section, which was given to the experimental group for eight weeks. The individual routine program was formed by best and worst performance analysis, individual interview, video analysis and conference with experts. The performance task was 540° back thrashing kick to break a pine board, and Competition Sport Anxiety Inventory-2(CSAI-2) was used to assess their psychological state. Two-way repeated ANOVA was used for data analysis with .05 of statistical significance level. In result, the routine practice showed that successive rate of the board breaking performance were increased while the control group did not show any change. Unexpectedly, any change in cognitive and somatic anxiety and confidence was found. The results indicated that the behavioral and cognitive routine program was effective to enhance the taekwondo performance, but the psychological state was not influenced by the routine program.

The relationship between the balance of autonomic nerve system and psychophysiological state

Hwang, Seunghyun, Korea Institute of Sport Science; Chang, Duksun, Korea National Sport University; Chung, Jihye, Sookmyung Women's University; Cho, Seongkwan, Texas A&M International University

The research on autonomic nerve system (ANS) has received increasing attention in the area of sport psychology in order to measure psychophysiological arousal and examine its relation to athletic performance. The heart rate variability (HRV) is used to evaluate the balance of ANS (Janelle & Naugle, 2012). Higher HRV means

psychophysiological composure while lower HRV produced by imbalance of ANS is interpreted as higher psychophysiological arousal and stress. Recent studies tested the validity of HRV by comparing HRV to Competitive State Anxiety Inventory-2 (CSAI-2), and comparing HRV between a stressful situation and a stress-free situation (Blasquez, Font, & Ortis, 2009; Murray & Raedeke, 2008). Thus, the aim of this study was to see the relationship between HRV and athletes' subjective report on psychological and physical state. The data was collected from two archery athletes and two basketball athletes for five days. Each day had five data collection points (two times in the morning and afternoon and one time in the night). The emWave pro. of Heart Math Institute was used to measure the balance of ANS, which is referred as Coherence, ranging from 0 to 16. For their subjective report on psychophysiological condition, we created and used two questions, 'How is your current psychological (or physical) condition"', on a Likert scale ranging from 1 (Very Bad) to 10 (Very Good). The Pearson's r is used to see the relationship between coherence and psychological and physical condition, and the statistical significance was set at .05. Not expectedly, HRV was not significantly related to subjective feeling on psychological and physical condition; however, the psychological and physical conditions were significantly related ($r = .53$, $p < .01$). This result indicates that the balance of ANS is not associated with subjective feelings on their condition, which suggests that more empirical and clinical studies should be conducted in the field of sport psychology to validate the use of HRV.

Immediate and sustained effects of acute exercise on Sternberg working memory in middle-aged adults

Huang, I-Lun, Yang, Wen-Chung, Chang, Yu-Kai, National Taiwan Sport University

A large body of research has evidenced that there are positive effects of exercise on cognitive and brain functions. Over the past decade, a majority of the literatures regarding the relationship between exercise and cognition has shifted attention from chronic exercise to acute exercise, and has observed that the improvement in cognition would generally be induced by acute exercise, particularly as it affects executive function. However, while previous studies have focused on exploring the immediate effects of acute exercise on executive function, there is a lack of studies focused on the sustained effects of acute exercise. Additionally, only a few studies have examined working memory, one of the primary cognitive processes within executive function. The purpose of this study was to examine the immediate and sustained effects of exercise on working memory during adults. Twenty-eight healthy adults were recruited, and were randomly assigned to either an acute exercise or a control group. The participants in the acute exercise group performed 30 minutes of cycling at moderate intensity, while the participants in the control group sat silently and read exercise-related books for 30 minutes. The Sternberg memory tasks were performed before treatment, immediately after treatment, 30 minutes after treatment, and 60 minutes after treatment. Our findings revealed that the acute exercise group had a significantly shorter response time, compared with the control group, on the Sternberg memory task at the immediately after time point. However, the response times were not significantly changed at the other two time points. In addition, the accuracy rate was not significantly changed by acute exercise at any of the three time points. These findings suggest that there are positive effects of acute exercise on working memory at the immediately after time point and has limited effects on dealy effect.

Anchoring movement and 'nerves': A study of anchored putting under low and high psychological pressure

Iso-Ahola, Seppo E., Dotson, Charles O., University of Maryland; Jagodinsky, Adam E., Clark, Lily C., Smallwood, Lorraine L., Wilburn, Christopher, Weimar, Wendi H., Miller, Matthew W., Auburn University

We report the first experiment shedding light upon whether restricting human movement provides technical and/or psychological advantage in competitive performance. This restriction can be accomplished by "anchoring" a putter to one's stomach. Many have argued anchoring takes "nerves" out of competitive performance, and golf's governing bodies banned anchoring starting January 1, 2016. This ban has implications for millions of golfers, especially professionals, whose livelihoods depend upon their ability to putt under pressure. To begin to determine whether the ban is justified, we tested the performance of participants with a wide variety of golf experience, participants with no experience to those who have golfed more than 100 times. These participants were tested in a laboratory setting where their performance with anchored and unanchored putters under low and high pressure was assessed. We found no evidence for a technical advantage due to anchoring but a clear psychological advantage: Participants who anchored their putters outperformed unanchored counterparts under high, but not low, pressure. Results offer preliminary evidence indicating the anchoring ban is justified.

An exercise in resistance: Inoculation messaging as a strategy for protecting motivation during a monotonous and controlling exercise class

Jackson, Ben, Gagne, Marylene, Proud, Lauren, Howle, Timothy C., Dimmock, James A., The University of Western Australia

Participating in an exercise activity for autonomous reasons has been shown to support engagement- and persistence-related outcomes, and as a result, sustained attention has been devoted to studying the factors that support (or thwart) individuals' enjoyment of, interest in, and value judgements regarding, their exercise activities. In this experiment, we employed a resistance- inducing (i.e., inoculation theory) messaging technique with the aim of protecting these desirable perceptions in the face of environmental conditions designed to undermine one's exercise experiences. We recruited autonomously-motivated participants (N = 146, Mage = 20.57, SD = 4.02) to perform a 25-minute, group-based, instructor-led exercise circuit, in which the activities were deliberately monotonous, and during which the confederate instructor acted in a disinterested, unsupportive, and critical manner. Shortly before the session, participants received either a control message, in which they were informed about the nature of the exercise circuit, or an inoculation message, in which they were forewarned about these potential challenges to their enjoyment/interest/value perceptions during the class, and provided with information about how they might maintain positive perceptions in the face of these challenges. We established that there were no between-condition differences in pre-session mood or general exercise motives. A one-way MANOVA exploring participants' impressions of the session revealed a significant multivariate effect, $F(2, 143) = 4.01$, $p = .02$, $\eta 2p = .05$, whereby the inoculated participants reported greater interest/enjoyment, $F(1, 144) = 8.08$, $p = .005$, $\eta 2p = .05$. A separate MANOVA testing for between- condition differences in participants' impressions of the instructor revealed that those in the control condition also reported significantly lower perceptions of autonomy-, relatedness-, and competence-support. This study is the first to demonstrate that inoculation messages may help protect desirable exercise experiences in the face of motivational challenges.

Hill on a Mountaintop: A longitudinal study of the relative age effect in an English Premier League Soccer Academy

Jackson, Robin, Loughborough University; Comber, Gavin, Brunel University London

While the relative age effect has long been established in soccer, little is known about the attrition rates of relatively older and relatively younger players once they have been recruited for an academy. Using birth date and retention data for 288 players from 2006 to 2014, we conducted a longitudinal study at a leading English Premier League Soccer Academy to compare the attrition rates of relatively older and younger soccer players from when they entered the academy (Under 9s) up to the Under 15 age group. To determine the extent to which relative age effects were due to selection bias rather than a pre-existing junior team age bias we also examined birth date distributions in the regional teams from which the large majority of academy players were recruited. Last, we conducted semi-structured interviews with four senior members of the academy (three head coaches, one senior recruitment officer) to examine their perceptions of (a) awareness of relative age effects at the academy, (b) challenges and constraints associated with relative age, and (c) measures used to account for relative age. Analysis of the birth date data at recruitment revealed significant quartile asymmetry, $X2(3) = 130.47$, $p < .01$, reflecting a very large relative age effect (H1:H2 ratio = 4.0) that was much greater than that found in the 691 Under-8 team players in the regional leagues (H1:H2 ratio = 1.3). Regarding retention, the "half life" of H1 players from 2006 to 2014 was found to be twice that of H2 players (H1 = 6.0 years, H2 = 3.0 years). This means that the relatively small proportion of younger players who were initially recruited were then further disadvantaged, with H2 players particularly likely to be released one year after joining the academy. These results will be discussed in relation to common themes emerging from the interviews that highlight the need for a strategically driven, organisational approach to addressing what is a complex and multi- faceted issue.

Videoconference-delivered physical activity peer support for adults with a spinal cord injury: A pilot study
Jeske, Samantha J.D., University of Toronto; Brawley, Lawrence R., University of Saskatchewan; Sabiston, Catherine M., Thomas, Scott G., Arbour-Nicitopoulos, Kelly P., University of Toronto

Group-mediated physical activity (PA) interventions are shown to be efficacious for increasing self-managed PA among adults with spinal cord injury (SCI). However, this population experiences time and space barriers to accessing such community-based PA programs. Real-time videoconferencing (VC) eliminates access barriers of in-person interventions and broadens peer support reach to both PA intenders and actors. A 4-week pilot study was conducted to evaluate the feasibility, acceptability and usefulness of delivering PA peer support group sessions for one hour on a weekly basis via Skype for adults with SCI. Baseline and post-program follow-up questionnaires were administered online to assess PA behavior, VC social cognitions and perceived fulfillment of task and social needs. Post-session online questionnaires assessed Skype platform usability and changes in group dynamics. Session implementation checklists were completed by a research assistant. Descriptive statistics and t-tests with Hedges' g effect sizes were conducted. Nine individuals (N = 9; M age = 42.89 +- 10.35 years; 88.9% male) participated with a 91.7% mean attendance rate. The average session duration was 79.6 minutes. The frequency of VC interruptions decreased at session 4 (e.g., 11 to 0 occurrences) indicating a decline in technical difficulties and participant interjections. At program follow-up, all participants agreed (M >= 3.70 out of 5) that they were given sufficient time, useful PA training resources and an engaging virtual space to learn and socialize. Group collaboration was indicated by increasing frequency of knowledge sharing and troubleshooting support by session 4. Large-between session effects were found for group cohesion, g = -1.06, and facilitator collaboration, g = -1.20. This pilot study demonstrates that VC holds potential for facilitating a cohesive, PA self-management training group. Future research should evaluate the efficacy of VC compared to an in-person group for enhancing social support and self-managed PA among adults with SCI.

Student-athletes' experiences of bullying on interuniversity teams
Jewett, Rachel, MacPherson, Ellen, Kerr, Gretchen, Stirling, Ashley, University of Toronto

Experiences of bullying have received substantial attention within scholarly and public domains, largely due to the detrimental outcomes associated with these experiences. Bullying has been defined as physical or verbal actions that have hostile intent, are repeated over time, and involve a power differential between the bully and the victim (Olweus, 1993). These behaviours can be expressed physically (e.g., hitting) and/or relationally (e.g., social manipulation; Archer & Coyne, 2005; Crick, Bigbee, & Howes, 1996). To date, research has focused primarily on bullying experiences of youth within school contexts, with minimal attention dedicated to other populations and peer-dominated environments, such as sport. Therefore, this study explored student-athletes' experiences of bullying in the interuniversity sport context. Eight team captains, including five males and three females, were interviewed about their experiences with bullying and the perceived experiences of their teammates as victims, perpetrators, and bystanders. The data were analyzed thematically and indicated that team captains perceived experiences of bullying behaviours, particularly relational bullying, as a common occurrence on interuniversity sport teams. The participants perceived that athletic ability, seniority on the team, age, personality characteristics, commitment to the team, and work ethic influenced one's responses to bullying experiences and whether or not one was victimized. Findings are interpreted in light of the unique features of sport contexts that may influence the occurrence and nature of the experience of bullying within the environment. Directions for future research will also be discussed.

Tuning the instrument: A phenomenological study of the somatic, affective and cognitive qualities of Qigong
Johansson, Mattias, Örebro University; Gustafsson, Henrik, Karlstad University

Qigong, the ancient Chinese mind-body technique, has in recent decades gained growing popularity as a way of managing stress and increasing well-being. Also researchers have shown increased interest and recent reviews of the literature point in the direction of beneficial outcomes. Qigong entails a combination of mental and physical techniques such as relaxation, slow movements, accompanied with a mindful focus on different body-parts, visualization, and self-massage. In this study we wanted to explore the experience of qigong. We chose to focus on three different levels of information processing; affective, cognitive, and somatic. Practicing qigong has been found to promote mindfulness and we therefore wanted to explore mindfulness on three different levels. Thus, in order to

help the participant to communicate the experiences, questions were asked about affective, cognitive, and bodily aspects of the experience of qigong. In order to stay as close to the momentary experience of this movement meditation as possible, an interview schedule was created, using a time-frame based on an actual qigong session. Participants for the study, four women and five men, were recruited through contacts with the Biyun Qigong Association of Sweden. Inclusion criteria included a minimum of 1 year of regular qigong (3-5 times a week). The study was approved by the Swedish Central Ethical Review Board. The interview transcripts were analyzed by way of Interpretative Phenomenological Analyses (IPA; Smith & Osborn, 2003). Preliminary analyses display somatic experiences such as warmth, aliveness and heightened sensitivity. Affective experiences are related to pleasantness, relaxation and a sense of happiness. Finally, the exercisers express a more distant relationship to their thoughts. By letting go of control, a sense of greater control is experienced over their thoughts. In the present talk we will discuss the preliminary findings and elaborate on the different levels of qigong experience as a way of increasing mindfulness of body and mind and general well-being.—*Örebro University*

The relationship between self-control and health, academic and athletic behaviors among NAIA athletes
Josephs, Molly V., Stapleton, Jessie, Missouri Baptist University

Self-control is an individual's ability to control and plan their actions and behaviors to achieve personal goals (Brown, Miller & Lawendowski, 1999; Zimmerman, 2000). Previously research has indicated that college students' self-control is associated with their nutritional choices (Redden & Haws, 2012), study habits (Tangney, Baumeister & Boon, 2004) and persistence at physical exercise routines (Dorris, Power & Kenefick, 2012). The purpose of this study was to evaluate the relationship between self-control and a variety of health, academic and athletic behaviors among collegiate athletes. The sample consisted of 385 National Association of Intercollegiate Athletics (NAIA) collegiate athletes (mean age=20.32 +/- 1.17). Data were collected via online questionnaires. Pearson correlations were conducted and revealed significant, positive correlations between self-control and academic performance ($r= .13-.23$, $p< .05$), fruit and vegetable consumption- weekday consumption ($r= .12-.13$ $p< .05$). Significant, negative correlations were found between self-control and athlete burnout ($r=-.28-.29$, $p< .01$) and alcohol consumption ($r=-.16-.35$, $p< .01$). The results indicate that NAIA athletes with better self-control have higher GPAs, consume more fruits and vegetables, less alcohol and experience less burnout in athletics than athletes with lower self-control. Future research needs to prospectively assess how self-control influences academic, health and athletic behaviors over the course of academic semesters. Prospective data may serve to identify if and when athletic departments need to implement self-control interventions as a means to promote positive health, academic and athletic outcomes among NAIA student-athletes.

How to succeed in PE class: The when, what and why of children's use of imagery.
Kacperski, Celina, Tobin, Danielle, Hall, Craig R., University of Western Ontario; Law, Barbi, Nipissing University

Imagery use has been associated with enhanced psychological and physical performance outcomes among children, both in sport (Munroe-Chandler et al., 2008, 2012) and active play (Tobin et al., 2015; Guerrero et al., 2015). Despite its potential benefits for enhancing physical activity-related thoughts and behaviours, little is known about children’s use of imagery in school-based settings (Westlund Stewart et al., 2015). The purpose of this qualitative study was to examine children’s use of imagery in physical education (PE) class, and their perceptions of its effectiveness. We conducted semi-structured focus groups with 17 children aged 10-14 years old ($M = 11.29$, $SD = 1.61$). Questions targeted the when, what, and why of imagery use in PE class. Children used imagery prior to PE class as well as during both general activities (e.g. instructional time) and competitive activities (e.g. basketball or track competitions) in class. Content varied as well; children's most reported themes were imagining how to practice a skill or how to apply a strategy, imagining how they succeeded or how they failed, and imagining their own emotions (e.g., confidence, anxiety). In terms of imagery function, children used imagery to improve their skills and game play, to motivate themselves, and to be more positive or increase their own confidence. Finally, most children found imagery useful, for example to remember a skill, or change into a more positive mindset. However it was not considered helpful when children were unsure how to use it, and they reported that it was debilitative when they felt that they pictured something incorrectly or when the imagery was anxiety inducing. Given that the participants in this study generally found imagery to be useful, integrating imagery skills into PE may be beneficial for encouraging physical activity motivation and development of fundamental movement skills.

The association between income and general lifestyle activity levels with meeting guidelines for leisure-time physical activity

Kakinami, Lisa, Wissa, Rita, Concordia University

Less than 1/3 of adults meet the weekly leisure-time physical activity (LTPA) recommendations (>= 150 minutes of moderate or vigorous intensity), with persons of lower incomes being disproportionately affected. Little is known about how general lifestyles may affect this association, and was the study's objective. Data were from the 2007-2012 National Health and Nutrition Examination Survey (NHANES, n=15,132), a nationally representative sample of the US adult population. Annual income was categorized into <20K, 20K-45K, 45K-75K, and >=75K (reference). Intensity and duration of lifestyle-related PA (paid and unpaid work, household chores, yard work, studying and training) and LTPA (recreation activities excluding lifestyle-related PA) were reported. Logistic regression adjusted for age, sex, race, education, marital status, and weight status. Sampling weights were used. Those with income <20K, 20K-45K, and 45K-75K and sedentary lifestyles were 50% (95% CI: 0.40-0.59, p<.0001), 43% (CI: 0.46-0.71, p<.0001), and 40% (CI: 0.51-0.70, p<.0001) less likely to meet LTPA guidelines, respectively, compared to those with >=75K. Those with income <20K, 20K-45K, and 45K-75K and moderately active lifestyles were 47% (CI: 0.37-0.76, p=0.001), 40% (CI: 0.45-0.80, p=0.0008) and 33% (CI: 0.51-0.88, p=0.005) less likely to meet guidelines compared to the reference, respectively. Those with income <20K, 20K-45K, and 45K-75K and both moderate and vigorous intensity in their lifestyle-related PA were 44% (CI: 0.37-0.84, p=0.006), 38% (CI: 0.46-0.85, p=0.003), and 36% (CI: 0.47-0.88, p=0.006) less likely to meet guidelines compared to the reference, respectively. There was no association for those with vigorous-intensity lifestyles. With the exception of the highly active, lifestyle-related PA did not eliminate the known association between lower income and decreased LTPA. Public health efforts should stress the importance of LTPA, especially among lower-income persons who are sedentary or moderately active in their general lives.

Impact of received support upon athlete's psychological health: different roles of coaches and teammates as a social support provider

Katagami, Eriko, Tsutsui, Kaori, Tsuchiya, Hironobu, Osaka University of Health and Sport Sciences

Recently, Freeman, et al. (2014) found that the relationship between received support and self-confidence and positive affect. However, the identification of beneficial support provider in sport context is still remained. Further clarification of social support will help the understanding of impact of social support on athlete’s psychological health. The aim of the current study was therefore to examine the impact of received support from coaches and teammates on athlete’s psychological health. One hundred and eighty three university student athletes (male＝114, female＝:69 Mean years＝19.98".49) from two Japanese universities volunteered to participate in the study. The Athlete Received Support Questionnaire (Freeman et al., 2014), Stress Response Scale (SRS: Suzuki et al., 1997), and Mental Health Scales for Atheletes-2(MHSA-2: Murakami, 2003) were used to measure athlete’s received support and psychological health. The results indicated that athletes received more support from teammates than coaches in general (t(180)=5.43, p<.001). Specifically, athletes reported higher frequency of emotional, esteem and informational support from teammates, but not of tangible support between the providers. The results indicated that received esteem support from teammates was found to be a predictor of low levels of psychological stress levels (β=-.45, p<.05). On the other hand, informational from teammates was identified to predict higher levels of psychological stress levels (β=.45, p<.05). There was no significant influence of other dimensions (i.e. emotional and tangible support) on athletes’ psychological stress levels. Moreover, receipt of support from teammates was correlated with athletes’ "willing ness to take a challenge", which is a sub-dimension of mental health (r=.20-.22, p<.05). In conclusion, the results in the current study showed that received support from coaches and teammates might influence on psychological health in different manner. These information seems to be useful to identify support an athlete or to develop supportive environment in their team.

Testing the multi-process action control model in a randomized controlled trial

Kaushal, Navin, Memorial University; Rhodes, Ryan E., University of Victoria

The well-substantiated intention-behavior gap has led to several new models to understand physical activity (PA). Multi- Process Action Control (M-PAC) is a comprehensive PA model that proposes that once intention is

established from outcome expectations (benefits of performance) and perceived control (ability and opportunity), then the success of translating this to behaviour depends on behavioural-regulation (self-regulatory tactics) (BR), affective judgments (expected pleasure) (AJ). Over time, M-PAC proposes that behavior is also maintained through the formation of identity (self-described role) and habit (stimulus-response bonds). The purpose of this study was to investigate the trajectory of change of these M-PAC constructs across time in a randomized controlled trial. Participants (n=142) were inactive new gym members and were randomized into a control or intervention group. The intervention group attended a workshop and created a planning sheet which included: habit building, scheduling, and making exercise enjoyable. Measures for both groups included accelerometry and M-PAC at baseline and eight week follow-up. Those in the intervention group showed a significant increase in MVPA after eight weeks ($d=.40$, $p<.05$) compared with the control group. Trajectory analyses found that outcome expectations, ability and opportunity did not differ ($p>.05$) between the two groups across time. By contrast, habit ($d=.57$), identity ($d=.33$), AJ ($d=.38$), and BR ($d=.42$), all significantly differed ($p<.05$) between the two groups over the eight weeks. Mediation analyses showed that AJ ($\beta=.21$), and BR ($\beta=.17$) were independent predictors of MVPA, and fully mediated (ab path $\beta=.30$) the relationship between group type and MVPA. Overall, the results strongly support the adoption phase of the M-PAC model and show some support for changes in identity and habit. An eight week trial, however, may not be sufficient to develop these maintenance-level constructs. The study highlights the importance of intervening upon post-intention constructs that should be considered in future PA trials.

The moral disengagement in doping scale

Kavussanu, Maria, University of Birmingham; Hatzigeorgiadis, Antonis, University of Thessaly; Elbe, Anne-Marie, University of Copenhagen; Ring, Christopher, University of Birmingham

The use of banned substances and methods to enhance performance, also known as doping, is a pervasive phenomenon in sport. Doping can have important negative consequences for athlete's health as well as for the integrity of sport. A construct that could enhance our understanding of doping behavior is moral disengagement. This refers to a set of cognitive mechanisms used to minimize negative affect that typically occurs when individuals violate their moral standards and engage in unethical behavior. The purpose of this research was to develop an instrument that measures moral disengagement in doping. We conducted two studies. In Study 1, football players (N = 506) responded to 12 items: two for each of the six mechanisms of moral disengagement that are relevant to doping. Confirmatory Factor Analysis revealed that a one-factor model with six indicators, one for each mechanism, fitted the data well; these items formed the Moral Disengagement in Doping Scale (MDDS). A second sample of athletes from a variety of team sports (N = 398) also completed the MDDS. The one factor model again fitted the data well and the scale showed invariance across males and females. In Study 2, we aimed to provide evidence for convergent, concurrent, discriminant and predictive validity as well as test-retest reliability of the MDDS. Athletes (N = 232) from a variety of team sports completed the MDDS and questionnaires measuring moral disengagement in sport, doping attitudes, moral identity, antisocial sport behavior, situational doping temptation, and task and ego goal orientations. A week later, a subsample (n = 102) completed the MDDS and indicated their likelihood to use a banned substance in a hypothetical situation. The relationships revealed between the MDDS and the other variables measured in this study were in the expected direction providing evidence for the convergent, concurrent, discriminant, and predictive validity of the scale. We also found evidence for test-rest reliability. In conclusion, the MDDS can be used to measure moral disengagement in doping in sport.

Latent growth analysis of levels of health coaching on motivation: A 12-month RCT

Kaye, Miranda P., Pennsylvania State University; Sforzo, Gary A., Micale, Frank, Ithaca College

Cognitive evaluation theory (Deci & Ryan, 1980, 1985) states that intrinsic motivation depends on experiences of autonomy and competence as well as a sense of relatedness. Health coaching (HC) is a potential mechanism for developing these perceptions, thereby mobilizing health related change. Employees enrolled in a workplace wellness program (N=280) were randomly assigned to varying levels of HC (G1=6 months of weekly sessions; G2=3 months weekly plus 3 months biweekly; G3=3 months weekly; and G4=no coaching until 6 months then weekly for 3 months). Autonomy, competence, relatedness and coaching sessions were assessed at baseline (0), 3, 6, 9, and 12 months. Despite access, nearly 1/5 of participants engaged in no HC (NC) over the 12-month study; G4 participants had higher NC than expected, $X2(3)=9.03$, $p<.05$. Latent growth curve modeling using a piecewise approach with

linear growth segments for 0-6 months (S1), and 6- 12 months (S2) indicated that when compared to participants without HC from 0-6 months (G4 and NC), participants with a healthy BMI (<25) who participated in HC had increased S1 autonomy, G1 b=0.18, p=.09; G2 b=0.19, p<.05; G3 b=0.21, p<.05, whereas those with BMI>25 in G3 had lower relatedness, b=-.14, p=.01. Regardless of group, those participating in HC had higher levels of competence (b=0.57-0.86, p<.08-.01) and relatedness (b=0.75-1.39, p<.05-.001) and significantly increased levels of S1 relatedness (G1 b= 0.55, p<.001; G2 b=0.41, p<.05; G3 b= 0.50, p<.001; G4 b=0.43, p<.01) when compared to NC participants; healthy participants significantly increased S2 competence (G1 b=0.48, p<.05; G2 b=.43, p<.05; G3 b=.46, p<.05; G4 b=.56, p<.01). These findings suggest that participants are less likely to utilize HC when it is withheld at the start of a structured workplace wellness program. Individuals experiencing lower competence and relatedness, who may have the most to gain motivationally, are the individuals who do not engage in HC. Employees engaging in HC experience higher levels of competence and relatedness than those who do not use HC.—*Institute of Coaching, McLean Hospital*

The influence of imposed optic flow on basketball shooting performance and postural sway
Kennedy, Joseph D., Armed Forces Services Corporation; Berg, William P., Miami University

At basketball games, fans often attempt to distract the opposing team's free throw shooters, hoping to have a detrimental effect on free throw performance. This study investigated the effectiveness of a unique distraction strategy. The specific purpose of the experiment was to determine the influence of imposed optic flow on basketball shooting performance and postural sway. If imposed optic flow can trigger the misperception of self- motion and consequent postural instability, might optic flow imposed on a free throw shooter during a shot impair performance by generating postural instability" Thirty- four men and women each performed 96 modified free throws, half in the presence of imposed optic flow, and half in a static environment. Optic flow was generated using a movable background behind the basket that translated horizontally as participants shot. Participants stood on a force plate while shooting to allow for the measurement of postural sway via recording center of pressure (CoP) position and computing the range in the anterior-posterior (AP) and medial-lateral (ML) axes. Imposed optic flow caused a reduction in free throw percentage from 56.7 % to 52.1% (p = .006). However, imposed optic flow had no effect on CoP range in either the AP (p = .990) or ML (p = .678) axes. Therefore, imposed optic flow negatively impacted shooting performance, but not by causing postural instability. Hypotheses are offered for how imposed optic flow could impair shooting performance by influencing aiming behavior.

Canadian university coaches' experiences and strategies for coaching first-year athletes
Kim, Jeemin, Wilfrid Laurier University; Bloom, Gordon A., McGill University; Bennie, Andrew, Western Sydney University

As student-athletes transition from high school to university, they are provided with new opportunities to develop their academic, athletic, and personal competencies (Miller & Kerr, 2002; Vallee & Bloom, 2005). Despite such benefits, transitioning into university introduces a number of challenges including balancing academic demands with higher standards of training and performance, moving away from family and significant others, and forming new relationships with peers and coaches (Bennie & O'Connor, 2006; MacNamara & Collins, 2010). Given that coaches have a significant influence on their athletes' experiences both inside and outside of sport (Bloom, Falcao, & Caron, 2014), the purpose of the current study was to investigate university coaches' perspectives on coaching first-year athletes. Semi-structured individual interviews were conducted with eight accomplished university coaches who had an average of 20 years of experience at this level. A thematic analysis (Braun & Clarke, 2013) revealed that coaching first-year athletes started with recruiting individuals who they felt would excel at their institution both athletically and academically, and who would fit within the current structure of their team. Coaches purposefully created inclusive team environments where they made sure their first-year athletes felt accepted and supported. This was achieved by building trusting relationships with these athletes and encouraging senior athletes to serve as mentors and role models. Outside athletics, coaches facilitated first-year athletes' academic achievements by monitoring their progress and encouraging the use of resources (e.g., tutors) available at their institutions. The current study makes a unique contribution to the literature that typically focused on first-year athletes' perspectives, by exploring highly experienced coaches' views. The findings offer practical strategies that can be used to ease the transition process from high school to university for first-year athletes.

Development and validation of the Brazilian Weight Teasing during Physical Activity Scale

Klein, Ashley R., Castro, Wesley A., University of Northern Iowa; Watanabe, Priscila I., Universidade Federal do Parana; Choi, Seong-In, University of Northern Iowa; da Silva, Michael P., Mazzardo Jr, Oldemar, Universidade Federal do Parana; Waldron, Jennifer, University of Northern Iowa; de Campos, Wagner, Universidade Federal do Parana; Fontana, Fabio E., University of Northern Iowa

Weight-related teasing is associated with loneliness, depression, eating disorders, and less physical activity. The purpose of the study was to develop and validate the Brazilian Weight Teasing during Physical Activity scale (WTPAS-BR) using the WCA scale as a prototype (Faith, Leone, Ayers, Heo, & Pietrobelli, 2002). The methods were divided into three phases. In phase 1, all six items of the prototype scale were revised to focus specifically on weight-related teasing. In phase 2, the revised prototype scale was cross-culturally adapted into the WTPAS-BR. The cross-cultural adaptation procedures occurred sequentially from translation, to content assessment by two clinical psychologists, and two field tests measuring the adequacy of the questionnaire among Brazilian adolescents. The field tests were bilingual technique (N = 11) and pilot study (N = 40). After each cross-cultural adaptation procedure, a committee discussed possible modifications to WTPAs-BR and made changes when necessary. In phase 3, the WTPAS-BR was psychometrically assessed (N = 111). An EFA with Oblimin Rotation and a CFA based on Chi2, RMSEA, CFI, GFI, AGFI, ECVI, CMIN/DF indices assessed the factorial structure of the WTPAS-BR. Internal consistency (Cronbach's a), convergent validity (r), and test-rest reliability (intra-class correlation) of the WTPAS-BR were assessed. The revisions made to the prototype scale qualified items to measure weight-related teasing. A rigorous and systematic cross-cultural adaptation process translated, and assessed the content and adequacy of the WTPAS-BR among Brazilian adolescents. A one-factor model with four items was adopted since all fit indices were above threshold and item factor loadings were > .70. The four item WTPAS-BR showed adequate internal consistency (Cronbach's a = .83), convergent validity (r = .82), and test-retest reliability (ICC = .96; 95% CI = .94 - .98). Strong validity evidence supports the use of the WTPAS-BR to measure weight-related teasing occurring during physical activity in Brazilian adolescents.—U*niversity of Northern Iowa Summer Fellowshp*

The association between sleep hygiene and self-reported sleep quality in elite athletes

Knufinke, Melanie, Nieuwenhuys, Arne, Geurts, Sabine A.E., Behavioural Science Institute, Radboud University; Coenen, Anton M.L., Donders Center for Cognition, Radbound University; Kompier, Michael A.J., Behavioural Science Institute, Radboud University

Sleep in elite athletes is crucial for recovery and performance, but has recently been found to be of low quantity. Poor sleep may result from inadequate sleep hygiene practices, that is environmental conditions and daytime behaviors that jeopardize sleep. To date, little is known about the prevalence of sleep hygiene practices in elite athletes and the extent to which these are associated with sleep. The present study aimed to provide initial insight in these matters. Participants were 98 elite athletes (56 female, 42 male) of different team- and individual sports, who competed at the highest national or international level. Sleep quantity, sleep quality and sleep hygiene were assessed at the habitual level by using established (sub)clinical questionnaires; and at a daily level, by means of diary-based monitoring for 10 consecutive days. To explore associations between sleep hygiene, sleep quantity and sleep quality, correlations were calculated. Habitual sleep quality was good for the majority of athletes, but a substantial minority was classified as poor sleepers (41%). Daily measures revealed long sleep durations (8:11 " 0:45hrs), but also long wake periods after sleep onset (12.56 " 18.84 min). Subjective ratings of sleep quality were hardly above average. With respect to sleep hygiene, measurement at the habitual level revealed irregular sleep-wake patterns, rumination and active pre-sleep behavior. In addition, at the daily level, blue light exposure appeared prominent (71% of the nights). Importantly, habitual sleep hygiene was associated with sleep quality (.45 < r < .50; ps < .001). At the daily level, similar associations were found, although for specific practices correlations could not be established. The current study provides insight in sleep hygiene practices of elite athletes. In revealing significant correlations between sleep hygiene, sleep quantity and sleep quality, results underline the importance of sleep hygiene and plead for interventions to increase regularity and decrease rumination and light exposure to optimize elite athletes' sleep.

Elite archers' perception on guided self-reflection and performance
Koh, Koon teck, Nanyang Technological University

Self-reflection has been shown to enhance professional development in clinical, counselling and educational settings (Davis, Thwaites, Freeston, & Bennett-Levy, 2015). Recent research also found that self-reflection can enhance performance in elite sports (Neil, Cropley, Wilson, & Faull, 2013). The purpose of this intervention study was two-fold: Firstly, to examine whether a guided reflective diary was effective in enhancing accuracy in elite archery, and secondly, to identify factors facilitating and hindering the usage of the guided reflective diary. Eight Singaporean elite archers (4 females, 4 males), aged 20 to 24 years, reflected on their training using the diary for a period of five weeks. Their pre- and post-intervention performance scores were calculated using Microsoft Office Excel to determine the mean and percentage differences. Results revealed that only two archers improved their performance after the intervention, whereas six performed poorer than before. Qualitative data were content analysed using the thematic method. This revealed three facilitating factors for the guided reflective diary usage: 1) serves as a reminder, 2) description of shooting feeling, and 3) enhance motivation. In contrast, (1) time-consumption, (2) high number of questions, and (3) the repetitive nature of the reflection questions were reported as the three most common hindering factors for the effective usage of the reflective diary. The results are discussed using the sport and coaching science literature. Practical implications are proposed to optimise athletes' use of reflection as a learning tool for personal improvement and performance enhancement.

Mental rotation of tactical instruction displays affects processing demand and execution accuracy of playing patterns in basketball
Koopmann, Till, Krause, Daniel, Steggemann, Yvonne, Baumeister, Jochen, Paderborn University

In sports games like basketball, coaches often use tactic boards to present tactical instructions during time outs (e.g., 20 to 60 seconds). Instructions have to be processed in a fast and errorless way. High affordances in visual-spatial transformation (e.g., mental rotation processes) are assumed to impede information processing and also to decrease execution performance with regard to the instructed playing patterns. In a within-subject design, ten novice students (23.4 years: SD = 1.43) were instructed with visual tactical instructions of basketball playing patterns on a lap-top screen either showing the playing pattern with low spatial disparity to the players' on-court perspective (basket at the top; 0"-orientation) or upside down (basket at the bottom; 180"-orientation). Twenty different playing patterns were presented in both orientations in an individually randomized order. Dependent variables were the observation time (information processing demand) and the radial error between the target positions and the actual executions (spatial accuracy) measured by video-analysis for three positions of the playing patterns (screen-, catch- and shot-position). The observation time for watching the patterns before execution for the 0"-orientation (M = 8.68s; SD = 3.36) was significantly shorter, $p = .001$; $d = 1.71$, as in the 180"-orientation (M = 13.73s; SD = 5.87). Furthermore, the ANOVA ORIENTATION (0", 180") x ACTION (screen, catch, shot) for spatial accuracy showed a main effect of ORIENTATION, $p = .023$; $\eta"p = .45$, as the radial error for the 0"-orientation (M = 112.3cm; SD = 14.1) was significantly lower compared to the 180"-orientation (M = 129.6cm; SD = 20.5). The effects are explained by interfering mental rotation processes that are necessary to transform the instructional perspective into the players' actual perspective while standing on the court or imagining themselves standing on the court. According to these results, coaches should align their tactic boards to their players' on-court viewing perspective.

The content of cognitive general imagery use in curling
Kouali, Despina, Westlund Stewart, Nicole, Hall, Craig R., Western University

Imagery is a psychological skill that creates or re- creates an experience in the mind, using all the senses (Vealey & Greenleaf, 2006). Athletes use imagery for cognitive and motivational functions (Hall, Mack, Paivio, & Hausenblas, 1998). One of the functions, cognitive general (CG) imagery (imagery of game strategies), has shown mixed results regarding its effectiveness on performance. To help fill this gap in the literature, this study examined the content of CG imagery use in curling. Participants were 14 female (n = 5) and male (n = 9) curlers (Mage = 57.57, SD = 19.94), competing at both recreational and competitive levels and predominantly playing the position of skip. Three focus groups were conducted using semi-structured interviews consisting of four-five participants in each group. The interviews asked participants questions regarding what skips image based on Munroe, Giacobbi, Hall, and

Weinberg's (2000) conceptual framework of imagery use. Interview transcripts were transcribed verbatim and analyzed by two researchers using both constant comparative and deductive methods. Five categories describing the content of the skips' CG imagery use emerged from the focus groups: sessions, effectiveness, nature, surroundings, and type. The results from the present study support previous research in both adult (Munroe et al., 2000) and youth athletes (Munroe- Chandler, Hall, Fishburne, O, & Hall, 2007; Munroe- Chandler, Hall, Fishburne, & Strachan, 2007). However, some differences from previous studies emerged, likely due to the nature of the sport of curling. Researchers and practitioners can use these findings to develop more beneficial CG imagery interventions and help athletes to achieve their performance goals.

Physical activity moderates the relationship of apolipoprotein E (APOE) genotype and dementia risk: A population-based study

Kovacevic, Ana, Fenesi, Barbara, Fang, Hanna, McMaster University; Oremus, Mark, University of Waterloo; Raina, Parminder, Heisz, Jennifer J., McMaster University

Many biological and lifestyle factors are independent risks for dementia. However, the effects of interactions between these factors remain largely unknown. The present study aimed to examine the relationship between the apolipoprotein E (APOE) genotype and dementia risk, as moderated by physical activity. The study sample consisted of 1693 participants (≥65y) from the Canadian Study of Health and Aging (CSHA). At baseline (1991), these participants were free of dementia and they underwent APOE genotype testing. Cases were diagnosed with probable dementia in 1996 (n = 1350); the control group consisted of the remaining persons in the baseline sample who remained dementia free in 1996 (n = 343). Sex, age, years of education, and health-related risk factors were included as covariates. Logistic regression analysis revealed that physical activity moderated the relationship between APOE genotype and dementia risk (R2 = .802; CI = [.258, 1.345]). For individuals with a genetic risk, exercisers and non-exercisers had a similarly high probability of developing dementia. However, for those without a genetic risk, exercisers were less likely to develop dementia than non-exercisers [$\chi 2$ (1, N = 1309) = 6.24, p = .012]. Furthermore, the probability of developing dementia for non-exercisers without genetic risk was not statistically different from the probability of developing dementia for individuals with a genetic risk [$\chi 2 > 3.331$, $p > .189$]. Given that the majority of the population does not carry the APOE ε4 allele, physical activity may be an effective preventive strategy to reduce the risk of dementia.

Initial development and validation of the deliberate practice self-efficacy scale

LaForge-MacKenzie, Kaitlyn, Baker, Joseph, York University; Young, Bradley W., University of Ottawa

Elite athletes must adopt and maintain deliberate practice behaviours (i.e., activities that require immense effort with no immediate rewards to help improve performance) over an extended period of time as a necessary aspect of skill acquisition (see Baker & Young, 2014 for a review). However, we have little understanding of the factors that might predict the maintenance of practice over time. The purpose of the present study was to design and preliminarily validate a measure of athletes' confidence in their capacity for deliberate practice (i.e., Deliberate Practice Self-Efficacy Scale, DPSES) based on the Deliberate Practice Framework (Ericsson, Krampe, & Tesch-R"mer, 1993). A literature review resulted in a sample of items that was reviewed by a panel of researchers from expertise development, skill acquisition, and/or self-efficacy. After initial vetting, the sample was arranged as six-factor, 41 item Likert-style scale. The DPSES was piloted on 99 competitive youth volleyball players (males = 63; females = 36, Mage = 15.62, SDage = 1.11; Mpractice = 10.47 hrs, SDpractice = 4.98). An exploratory factor analysis (varimax rotation) resulted in ten factors with eigenvalues over Kaiser's criteria of 1 but an examination of the factors after rotation showed four factors with less than 4 items. These factors and subsequent items were deleted, demonstrating a six-factor, 34-item design. The items clustered differently than originally hypothesized, resulting in six amended factors. Further tests of concurrent validity showed significant and near-significant correlations between total accumulated weekly practice hours and four of the six factors. Future research will continue to develop and validate the DPSES with a larger sample of athletes across a more diverse range of sports.

Practice and imagined performance of effortful self-control affect cardiovascular exercise endurance: preliminary findings

Langvee, Jason H., Graham, Jeffrey D., Zering, Jennifer C., Bray, Steven R., McMaster University

Self-control underpins successful performance in many areas including sport and exercise (Hagger et al. 2010a). Actively exerting self-control on one task leads to negative carryover effects for future self-control performances (Hagger et al., 2010b). Several studies have shown practicing tasks that require active exertion of self-control leads to improvements in self-control on tasks other than those that were practiced (Berkman, 2015). However, studies also show that simply imagining exerting self-control leads to negative performance carryover effects (Graham et al., 2014), which suggests imagery training may also be used to improve self-control. The purpose of this study was to investigate effects of active training and imagery training of self-control tasks on cardiovascular exercise endurance performance. Participants (N = 34) completed a graded exercise test to exhaustion (GXT) during each of two testing sessions, separated by 2-weeks of daily self-control training. After performing the first GXT, they were randomized to a control group (n = 12) that maintained a logbook of food consumption or one of three daily-training conditions: endurance handgrip squeezing (n = 9), 5- minutes imagery of the endurance handgrip squeezing (n = 6), or 5- minutes imagery of the GXT (n = 7). Upon completion of training, they completed the second GXT. Relative to controls, each of the handgrip (d = 0.77), imagined handgrip (d = 0.21), and imagined GXT (d = 0.58) training groups showed improvements in endurance on the GXT over the two testing sessions. However, only the effect size for the endurance handgrip-squeezing group approached significance (p = .07). Results are consistent with previous research showing handgrip training improves cardiovascular exercise performance (Bray et al., 2015) and suggests imagery training may also be used to improve self-control. Imagery and imagery training involving tasks that require self-control may induce similar neurological activation and adaptations in prefrontal areas engaged by actively performing such behaviours.

Transferring adolescent girls' motivation to exercise: from school to leisure Preliminary results of a trans-contextual study

Laroche, Julie-Anne, Lamoyne, Jean, Université du Québec à Trois-Rivières

Scientific and empirical evidence suggest a significant decline in physical activity behaviors during adolescence. In Quebec, multiple school-based initiatives are conducted, but little is known about its outcomes, on a motivational perspective. In this regard, the Trans- Contextual Model (TCM) is a combination of two well-known theoretical models: the self-determination theory (SDT) and the theory of planned behavior (TPB). This framework provides an interesting perspective to assess about long- term, transferable motivational impacts of school-based interventions. However, no TCM studies have been conducted among French Canadian, adolescent populations. The first purpose of this study is to validate a French version of a TCM questionnaire. The second aims to analyze the relationships between SDT (supervised context) and TPB constructs (leisure time context). This study is a pilot, preliminary phase of a larger scale research. 29 adolescents girls (15.8 SD 1.1 years old), involved in a school-based intervention (Fit Spirit), accepted to participate in the study. They completed a 64-item questionnaire, measuring SDT constructs, autonomous motivation, and TPB variables (in leisure time physical activity). Psychometric analyses were conducted to assess reliability for each scale. Correlations were calculated to verify for correspondence between each of the model's constructs. Psychometric properties were satisfying for most scales [$\alpha>.70$, except for amotivation ($\alpha=.32$), and identified regulation ($\alpha=0.45$)]. Correlational analyses revealed that support for basic psychological needs in the supervised context were significantly associated with attitudes (autonomy, $p<.05$), perceived behavioral control (autonomy, competence, relatedness, all at $p<.05$), and intentions to exercise in leisure time context (autonomy, competence, $p=.01$). This study contributed to validate a French version questionnaire measuring the components of TCM. This is a significant asset to measure change (or stability) in motivation towards exercise behaviors between a supervised and leisure contexts.

Trained women do not show difference psychological response to psychosocial stress compared with untrained women

Lautenbach, Franziska, Elsner, Stefanie, Thomas, Laura Isabell., Borges, Uirassu, German Sport University, Institut of Psychology; Mombartz, Annika, University to Cologne, Department of Psychology

It is often assumed that trained individuals have a better response to stressful situa-tions (i.e., lower levels of cortisol, lower heart rate, less self- perceived stress). Es-pecially, for cortisol empirically evidence has mainly been used from one study: Rimmele and colleagues (2007). In order to provide additional empirical evidence also for women, we compared the psychophysiological stress response to the Trier Social Stress Test"Groups (TSST-G; van Dawans, Kirschbaum, & Heinrichs, 2011) in trained and untrained women. In a between-subject design, 43 female volunteers (no oral contraceptives; 11 untrained: Mage = 45.2 SD 10.3; 15 trained: Mage = 41.1 SD 13) participated in the TSST-G. Cortisol samples were collected seven times. Simultaneously, subjectively perceived stress using a visual analogue scale ranging from 0 ("not at all") to 100 ("very much") was assessed. Testing was performed between 1 p.m. and 7 p.m. to account for circadian rhythm for cortisol responses (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004). Repeated measures analyses of variance (rmANOVA) showed a significant increase in cortisol due to the TSST-G, $F(6,144) = 9.23$, $p = .001$, ηp2.28. No signifi-cant main effect was found for subjectively levels of stress, $F(6,144) = .95$, $p = .46$, ηp2 = .04. We did not find expected interaction effects, neither for cortisol ($p = .87$) nor for subjective levels of stress ($p = .68$). See figure 1 for detailed results. We provided additional evidence for the TSST-G with female participants as a valid instrument to increase cortisol levels. However, our data did not show an interaction with sport participation and thus, is contrary to the data presented by Rimmele and colleagues (2007). This might be due to the age differences between the studied groups (Mage = 21.72 in Rimmele et al., 2007). However, as descriptive data leans in the direction that cortisol and subjectively perceived stress is higher in untrained females than in trained females as a reaction to a psychosocial stressor, future research should increase sample size--*Internal University Funding by the German Sport University*

How do enthusiast cyclists conceptualize road bicycle comfort?

Lavoie, Maryse, Dorey, Jonathan, Guastavino, Catherine, McGill University

Bicycle comfort is of broad and current interest to the cycling community as demonstrated by the large number of magazines, books and online forums on the topic. Yet, if comfort has been investigated for decades in the automotive, railroad and aviation industries, it has received scant attention for cycling in the scholarly literature. In addition, as cyclists actively interact with the bicycle to move forward, the notion of comfort, traditionally limited to passive exposure, is extended to dynamic situations in the context of riding a bicycle. The few previous studies on the topic have investigated how road bicycle comfort is conveyed in specialized magazine articles and online forums. The present study extends this investigation using face-to-face semi-structured interviews with 19 enthusiast cyclists (4,500 km/year on average) to determine how they conceptualize bicycle comfort and how they describe it spontaneously, in their own words. Interviewees were asked to define bicycle comfort, describe what makes a ride comfortable or not, discuss the influence of various criteria (such as distance, road quality, level of effort, vibrations), as well as the distinction between static and dynamic comfort. A qualitative exploration of the free-format descriptions based on grounded theory and linguistic discourse analysis of the transcribed interviews reveals that bicycle comfort is a complex notion, associated with physiological and psychological outcomes for the cyclist (e.g. energy level, pain), as well as characteristics of the bicycle itself (e.g. wheels, accessories) that are moderated by situational factors (e.g. environment, distance, duration).

The effect of silver taekwondo program on successful aging and psychological benefit

Lee, Cheong-Pyo, Chang, Duksun, Korea National Sport University

The physical activity participation is a key issue for older people's life. The aim of this was to see the impact of senior citizens' participation in a taekwondo demonstration activity on successful aging and healthy leisure life. Ten older people aged at 70.90 in average participated in a taekwondo demonstration program for eight weeks. Each week had two sessions for two hours. Data were collected through video recording, classroom observation, evaluation form, in-depth interview and a questionnaire for successful aging. By qualitative and quantitative analytical approaches, this study explored changes in their physical, cognitive, emotional and social aspects of

successful aging after the program participation. None of statistically significant results was found on sub-components of successful aging, but the qualitative analysis provided meaningful results. The psychological benefit of the participation in the taekwondo demonstration was in mood changes, such as fun, expectation, achievement and self-confidence. They also expressed feelings like shyness, tension and pressure. In addition, they could extend their social networks. These results suggest that participation in the taekwondo demonstration program may positively influence not only physical health but also social and emotional health in the life of old people. This result may contribute to the vitalization of silver Taekwondo demonstration as a physical activity program for various populations.

A longitudinal investigation of coach transformational leadership behaviours and positive youth development in athletes.

Lefebvre, Jordan S., Cowburn, Ian, Queen's University; Erickson, Karl, Michigan State University; Martin, Luc J., Cote, Jean, Queen's University

Coaches exert a considerable influence on the psychosocial development of athletes through their interactions and relationships. Notably, transformational leadership (TFL) has been advocated as an optimal framework to investigate the effect of coach behaviours on athletes' development (Callow et al., 2009). There is preliminary evidence suggesting the benefits of TFL for Positive Youth Development (PYD; Price & Weiss, 2013; Vella et al., 2013). Nevertheless, the studies conducted to date have been cross-sectional, and as such, Vella et al. (2013) advocated the measurement of PYD using multiple time points-thus, inferring causality between TFL and PYD. The purpose of this study was to examine the relationship between TFL behaviours in coaches and PYD in athletes over the course of a season. The participants were 73 athletes (Mage = 14.26, SD = 1.27, 40 female) from seven soccer teams. They were asked to complete a measure of TFL (TTQ; Beauchamp et al., 2010) and 4 measures of PYD assessing athlete competence, confidence, connection, and character (4Cs; Vierimaa et al., 2012) at the beginning and end of a 4-month season. K-means Cluster analysis based on athletes' longitudinal developmental trajectories according to PYD outcomes (4Cs) revealed the presence of three distinct clusters that indicated PYD changes throughout the season: 1) increasing PYD, 2) constant PYD, and 3) decreasing PYD. TFL coach behaviours were subsequently compared across all groups. ANCOVA investigated TFL at T2 while controlling for T1, revealing significant differences between the clusters. Simple contrasts revealed that athletes in the increasing group (M = 3.39) and constant group (M = 3.13) reported significantly higher levels of TFL coach behaviours than athletes in the decreasing group (M = 2.75). The results suggest that athletes who increased in PYD outcomes, or remained constant, perceived their coaches as engaging in higher levels of TFL behaviours. This short-term longitudinal study provides further evidence of a causal relationship between coach leadership behaviours and PYD.

How did it end? Investigating the lifespans of former professional basketball players

Lemez, Srdjan, York University; Wattie, Nick, University of Ontario Institute of Technology; Lawler, Tyler, Division of Epidemiology and Public Health, City Hospital; Lawler, Frank, Department of Family and Preventive Medicine, University of Oklahoma Health Sciences; Baker, Joseph, York University

The epidemiology of diseases and causes of death (COD) can be complex. For example, intentional self-harm (i.e., suicide) can be a psychological by-product of physical trauma, such as a traumatic brain injury incurred from playing a highly competitive sport. In recent years, death related to traumatic brain injury has received increasing media and social media attention. However, the information on athlete COD presented by media may be influenced by the popularity of athletes and the circumstances around their COD. As such, media portrayals may not be representative of athlete mortality trends. The purpose of this study was to analyze former National Basketball Association (NBA) and American Basketball Association (ABA) players who had died as of December 11, 2015. We studied the variation of their lifespan longevities and COD in relation to biological (i.e., age, birth decade, race, playing Body Mass Index, and handedness) and occupational (i.e., career length, playing position, and decade of entry into the NBA or ABA) characteristics. The 2016 World Health Organization's International Classification of Diseases was used to categorize COD. We located COD for 514 out of a total of 787 (M = 68.11 years; SD = 16.03) players through numerous publicly available sources, such as local newspapers (e.g., www.baltimoresun.com), national newspapers (www.nytimes.com), and obituaries (e.g., www.legacy.com). The most common COD were diseases of the circulatory system (e.g., ischaemic heart disease; n = 143), malignant neoplasms (i.e., cancers; n =

138), natural/old age (e.g., metabolic syndrome; n = 92), and accidents (e.g., car accident; n = 43). White players had a higher incidence of death from natural/old age causes (OR 2.46, 95% CI: 1.38–4.37) relative to black players, while black players had a higher incidence of death from homicide (OR 2.53, CI: 1.05–6.10) relative to white players. Our findings suggest that psychosocial and lifestyle risk factors, in accordance with other health indicators, contribute to deaths in former professional basketball players.—*Ontario Graduate Scholarship*

Sport and Non-Sport Practitioners Perception of unsporting behaviors: Influence of individual and external factors

Limon Luque, Margarita, University Autonoma of Madrid (Spain); Rodriguez, Alejandra, Universidad Autonoma Madrid; Borras, Pablo, Estudiantes Basketball Club

The aim of this research is to provide a deeper understanding of how unsporting behaviors are perceived by sport practitioners vs. non sport practitioners. Our main research questions were: A) Are sport practitioners more tolerant to unsporting behaviors than non-sport practitioners? B) What personal and external variables influence sportsmen's perception of violent unsporting behaviors? We focus on two individual variables (gender and social identity), and on two external variables: The type of sport practiced (individual vs team sports), and the specific sport played (soccer vs basketball vs. individual sport) 240 individuals (16-18 years-old, 120 male, 120 female) participated in the study distributed in four groups (n=60 per group): Soccer, basketball, tennis players and non-sport practitioners. Participants were asked about their favorite soccer team, and completed the Cameron's (2004) questionnaire of social identity. A questionnaire (18 common unsporting situations in a soccer game) was developed. In half of the situations the unsporting behavior was initiated by the local team, and in the other half, by the rival team. Participants judged in a Likert scale (1-5) to what extent they considered each situation was an example of a violent behavior. Later, the same situations were presented, but the protagonists the unsporting behavior were well known soccer players of Real Madrid, Barcelona & Atletico Madrid (half of them examples of high fair play, and the other half of poor fair play). Results showed that soccer players perceived the unsporting behaviors as less violent than the other groups. Team sportsmen were more tolerant to unsporting behaviors than individual sportsmen, and non-sport practitioners. Male participants were more tolerant than female participants. Unsporting behaviors initiated by high fair play soccer players were rated as less violent than those ones initiated by low fair play soccer stars.This effect occurred more in the female group. Participants with a higher level of identification with their team showed in-group favoritism bias.

A test of the risk perception attitude framework in the physical activity domain among adults with multiple sclerosis

Lithopoulos, Alexander, Latimer-Cheung, Amy E., Queen's University

Interaction effects between risk perceptions and efficacy beliefs on physical activity (PA) have received little empirical attention. Additional research examining these effects is important for the development of theory and PA interventions. Furthermore, research in this area involving people with chronic disease such as multiple sclerosis (MS) may be particularly valuable because of the high prevalence of inactivity (Sandroff et al., 2012) and consequent missed opportunity to reduce the degree of disability associated with MS (Motl, 2010). The risk perception attitude (RPA) framework (Rimal & Real, 2003) predicts that people with MS who have high risk perceptions (for health threats associated with MS; e.g., risk of falling)/high efficacy beliefs are most likely to do PA. Therefore, the main objective of this study was to test this hypothesized interaction in the PA domain among people with MS. Also, it is unclear whether measures assessing higher order constructs such as risk perceptions and efficacy beliefs should be created using additive (i.e., adding or averaging lower-order construct measures) or multiplicative (i.e., multiplying lower-order construct measures; Popova, 2012) techniques. Therefore, a second objective was to compare the results of analyses including measures created using additive or multiplicative techniques. Participants (N=262; Mage=41.62; SD=9.47) completed measures assessing risk perceptions (susceptibility/severity of health threats) and PA efficacy beliefs (task/response efficacy), intentions, and behaviour. Moderated regressions did not show any interactions (ps>.17), or main effects for risk perceptions (ps>.39); however, efficacy beliefs consistently predicted intentions (ps<.001; betas>.48) and behaviour (ps=.001; betas=.23). The results also did not differ between analyses including measures created using additive or multiplicative techniques. In summary, this study found partial support for the RPA framework. Also, these results suggest that, in

this context, additive and multiplicative techniques may be equally appropriate.—*Canadian Institutes of Health Research - Canada Research Chairs Program*

Coordination exercise and cognitive function in obese preadolescence: An RCT study
Liu, Jen-Hao, Song, Tai-Fen, Chen, Feng-Tzu, Chang, Yu-Kai, National Taiwan Sport University

Obesity is an increasing cardiovascular-related health condition in children. Physical activity plays an important role in preventing obesity, and reducing the risk of obesity in adulthood. A large number of studies have revealed that aerobic exercise benefits multiple cognitive functions in younger and older adults. However, whether the beneficial effects of exercise on executive functions extend to other exercise modality and obesity related problems in preadolescents remains understudied. Additionally, no study has examined the exercise effects on food-cue related executive functions. The purpose of the current study was to investigate the effect of a coordination exercise program that supplied multifaceted characteristics related to physical fitness on obesity and cognitive functions among obese preadolescents. A randomized control intervention was employed. 70 obese preadolescents were randomly assigned into either a coordination exercise group or a waiting list control group. Exercise interventions involved a jump rope exercise with moderate intensity, performed for 75 minutes per session, twice per week, for 12 weeks. All participants performed physical fitness as well as a normal and a food-cue related Stroop Test prior to and following the treatments. The results showed that a coordination exercise intervention leads to improved physical fitness and reduced obesity status. Similar beneficial effects were also revealed for both normal and food-cue related cognitive functions, with those task conditions requiring more executive function showing greater facilitation. Lastly, positive changes in physical fitness and obesity status are correlated with better cognitive functions. In obese preadolescents, the coordination exercise intervention may be an effective approach to improving physical fitness, reducing the obesity status, and increasing multiple aspects of cognitive functions, in which the improvement in obesity related inhibition may play a role between exercise and weight loss in obese preadolescents.

A critical view on the notion that exercise improves cognitive performance
Liu, Sicong, Lebeau, Jean-Charles, Tenenbaum, Gershon, Florida State University

Although extant meta-analyses supported the notion that exercise causes improvement in cognitive performance, methodology shortcomings exist among primary evidence. The present study examined relevant randomized controlled trials (RCTs) published in the past 20 years (1996-2015) for potential methodology issues. Results revealed that RCTs supporting the positive effect of exercise on cognition are likely to include Type I Error(s). This result can be attributed to the joint practice of gain score analysis on pretest-posttest data as well as the presence of a control group advantage over the exercise group on baseline cognitive measures. To improve accuracy of causal inferences in this area, analysis of covariance on pretest- posttest data is recommended under the assumption of group equivalence. Important experiment procedures are discussed to maintain group equivalence.

Examining links between perceived exercise pattern, attributions, and exercise-related cognitive errors
Locke, Sean R., Brawley, Lawrence R., University of Saskatchewan

Background: Some individuals perceive themselves as regular exercisers when exercising twice a week while others view regular exercise as six days a week. Such differential perceptions may be influenced in part by the self-reflection associated with attributions. Attributions (Weiner, 2010) concern causes that individuals express about their successes or failures. They have been shown to be related to future behavior. Attributions about the regularity of exercise may differ between individuals who express differences in pattern of weekly exercise. However, information used to help form attributions could be biased by exercise-related cognitive errors (ECEs). Based on work by Locke & Brawley (2015), ECEs should be related to attribution styles and negative thoughts. Hypotheses: Individuals who perceive their exercise pattern as strongly inconsistent will make more uncontrollable, stable and external causal attributions and express more negative thoughts. Method: Participants (N = 316, Mage = 29.3) completed an online questionnaire and responded to measures of exercise pattern, Causal Dimensions Scale II, acute exercise thoughts, and ECEs. Results: Using Welch's ANOVAs, results indicated individuals perceiving more inconsistent exercise patterns reported more external, less stable, and less personally controllable attributions as well

as more negative exercise thoughts compared to those perceiving consistent patterns (ps < .05; Cohen's ds = .30 to .60). Higher ECE scores were correlated with more external, less stable and less personally controllable attributional causes (ps < .05). Discussion: In agreement with Weiner's 2010 model, unsuccessful (i.e., inconsistent) exercise patterns revealed attributional causal dimensions incompatible with effective self-regulation. In line with the cognitive errors model, those reporting high ECEs express one-sided negative thoughts about exercise; the kind of information characteristic of biased thinking. We discuss whether ECEs are a potential reason why causal reasoning about exercise may go astray.—*SSHRC doctoral award to the first author and SSHRC Canada Research Chair training funds to the second author.*

Coaches' interpersonal style, basic psychological needs and positive/negative affects of semi-professional soccer players: A longitudinal analysis

Lopez Walle, Jeanette M., Tristán Rodríguez José L., Rodenas Cuenca, Luis T., Barbosa Luna, Adrian E., Universidad Autonoma de Nuevo Leon; Tomás Marco, Inés, Universitat de Valencia

Coaches' interpersonal styles have positive and negative implications for the psychological experiences of young athletes (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Gonzalez, Castillo, Garcia-Merita, & Balaguer, 2015; Tristan et al., 2014). We examined whether changes in soccer players' perceptions of the coaches' interpersonal style (autonomy supportive and controlling) predicted changes in the semi-professional players' basic needs satisfaction/needs thwarting, and in turn, variability in their reported over the course of a season. A field correlational longitudinal design, including two data collections over the course of a competitive season, was used. The participants were 177 semi-professional soccer players aged between 15 and 24 years old (M = 17.81, SD = 1.98). The results confirmed the reliability for each of the questionnaires (alpha range = .82 - .96). Structural Equation Modeling (SEM) analysis showed an adequate fit of the data (chi^2/df = 3.79, CFI = .90, IFI = .90), at the beginning of season, the autonomy support positively predicts the satisfaction of basic needs (beta = .45, p < .01) and negatively the basic needs thwarting (beta = -.32, p < .01) at the end of the season; in turn, at the beginning of the season perceptions of a controlling interpersonal coaching style positively predicts thwarting (beta = .23, p < .01) and negatively satisfaction of basic needs (beta = -.20, p < .01) at the end of the season; the satisfaction of basic needs positively predicted positive affect (beta = .44, p < .01); and basic needs thwarting positively predict negative affect (beta = .41, p < .01) at the end of the season. Finally, results showed that the controlling interpersonal coaching style at the beginning of the season predicts negative affect at the end of the season (beta = .26, p < .01). Thus, it is confirmed that coaches' interpersonal styles at the beginning of the season influence the satisfaction and/or thwarting of basic needs and these in turn predict the positive and negative affects.

Renegotiating identity: College transitions for former high school athletes no longer engaged in varsity competition

Lyons, Logan K., Utah State University; Bell, Lydia F., National Collegiate Athletic Association; Mason, Laurel G., University of Arizona; Dorsch, Travis E., Utah State University

Much research has examined the influence of athletic identity on college student-athlete experiences (e.g., Killeya-Jones, 2005). Additionally, scholars (e.g., Brewer, 1991) have attended to the effects of identity foreclosure for college student-athletes at the end of their careers. However, despite the fact that over 90% of high school athletes do not participate at the intercollegiate level, little scholarly work has examined the foreclosure of athletic identity in non-participating college students who maintained a strong athletic identity during high school. The present research explores how former high school athletes renegotiate their identity during their transition to a non-participating college student. Using a phenomenological approach (see Groenewald, 2004), in-depth, semi-structured interviews were conducted with 13 first-year students at a large university in the southwestern United States. Interviews were conducted at three time points: (1) the end of the first month of college, (2) the end of the first semester, and (3) the end of the first year. Commonalities among participant experiences existed as they transitioned into college. Specifically, not being a member of a varsity team left participants with a sense of loss, but also afforded them experiences of camaraderie outside of organized athletics. These experiences were beneficial to students in relation to their ability to acclimate to their new non-athletic athletic identities. Findings shed light on a transition experienced by more than two million emerging adults every year (NFHS, 2014). Moreover, they deepen current

understanding of athletic identity foreclosure and offer suggestions for future research related to the college transition.

Self-determined and achievement motivation profiles of youth elite athletes: A cultural extension of the achievement goal theory

Mabuta, Kapule D., Malete, Leapetswe, University of Botswana

This study examines the self-determined motivational profiles and goal orientation profiles of elite youth Batswana athletes. Eighty-two male and female national team athletes taking part in the African Youth Games completed the revised Sport Motivation Scale (Pelletier, Rocchi, Vallerand, Deci & Ryan, 2013) and the Perception of Success Questionnaire (Roberts, Treasure & Balague, 1998). Test of the scales' internal consistency demonstrated that they had good fit for use with the current population. Results indicated that elite Batswana youth athletes had significantly higher autonomous motivation than controlling motivation. They had high task- high ego orientations with female athletes playing individual sports relatively more task oriented and more ego oriented than their male peers. Intrinsic-identified motivation was significantly and negatively associated with ego goal orientation. External regulation was significantly and positively associated with intrinsic- identified regulation, introjected regulation and amotivation. Type of sport predicted intrinsic-identified regulation and introjected regulation of self-determined motivation. The athletes had high levels of self- determined motivational profiles characterized by high task-high ego goal orientations. We did not directly examine the relationship with culture. However we believe that the predominantly collectivistic cultural influences could have an influence on self-rating on motivational orientations of Botswana youth athletes. Future research could examine this relationship and its potential impact on sport participation and achievement.

Exploring a coach's application of andragogical principles in the facilitation of learning for Masters and youth canoe/kayak athletes

MacLellan, Justin, University of Ottawa; Callary, Bettina, Cape Breton University; Young, Bradley W., University of Ottawa

Andragogy is an educational framework for understanding how adults learn (Knowles et al., 2012). Although it has yet to be applied in sport, work suggests it may suitably frame adult (Masters) athletes' learning processes in coach-facilitated situations (Callary et al., 2015; Young & Callary, 2016). Using an instrumental case study design (Punch, 2005), we aimed to determine if a coach's approaches to learning situations align with andragogy and whether these approaches vary when coaching Masters and youth athletes. The participant was a female canoe/kayak coach at a club in Nova Scotia, who had experience as a coach and athlete in the sport, and who regularly coached both Masters (30-65 yrs) and youth (12- 15 yrs) cohorts. Three semi-structured interviews lasting 90-120 minutes explored how the coach employed andragogical principles when facilitating learning for the two cohorts. Probes were informed by participant observation of learning situations that occurred in practices prior to the interviews. Deductive content analyses were conducted, whereby quotes were organized categorically based on Knowles et al.'s six principles: need to know, self-directed learning, prior experiences, readiness to learn, problem-oriented learning, and motivation to learn. Results showed that the coach explained how her Masters athletes (MAs) required greater explanation for training prescriptions and how she engaged MAs in collaborative conversations to provide this rationale. Further, the coach described how she was more apt to offer MAs decision-making opportunities as a group, allowing them to act as co-participants in the planning of their learning. The coach highlighted that MAs were not as physically coachable as the youth, lacking the motor skill to transfer learned material to proper execution, partially attributed to by the many obligations that curtailed their time commitment to the sport. Findings suggest that although elements of each principle were evidenced in the coach's approaches with both cohorts, their application differed and was highly nuanced in comparison.—*Social Science and Humanities Research Council (SSHRC) Joseph Armand Bombardier Canada Graduate Scholarship (awarded to J.MacLellan, University of Ottawa); SSHRC Insight Development Grant (awarded to B. Callary, Cape Breton University); University of Ottawa Faculty of Health Sciences Travel Grant (awarded to J. MacLellan, University of Ottawa)*

Development of the athlete regret scale

Madrigal, Leilani, University of Nebraska; Robbins, Jamie E., Methodist University

Regrets are negative emotions experienced by individuals who deem their choice in a given situation to be incorrect (Zeelenberg, 1999). Experienced regrets may harm overall well-being, whereas anticipated regrets can lead to more effective decision making (Dijkstra & Bareld, 2008; Robbins & Stanley, 2012). Past research identified the prevalence of regret feelings in various athlete populations (Robbins & Stanley, 2013), but studies on this topic are scant likely because there is no existing regret scale or survey. The current study aimed to develop a scale to assess this emotion among athletes. A total of 317 Division I and II NCAA athletes (men n=192; women n=125) responded to 52 statements regarding existing regrets as a result of actions or inactions from their season. The statements were derived from previously identified regrets listed in the research which reflected general areas of relationships, sport behaviors, health, cognition, performance, life skills, and control (Robbins, Madrigal, & Stanley, 2015). Factor analysis (PCA) results reduced the scale to a one-dimensional 25-item scale, with good reliability, Cronbach's alpha =.94. Future directions in research and applied work with regard to this scale, including utilizing findings to modify athlete decision making will be discussed.

Mental toughness and regrets

Madrigal, Leilani, University of Nebraska; Robbins, Jamie E., Methodist University

Athletes at the college level are faced with numerous obligations, pressures, and decisions, leaving them with multiple chances for making ineffective selections in their athletic, academic and personal lives. These decision errors have the possibility of encouraging feelings of regret, which may negatively impact well-being (Torges, Stewart, & Miner-Rubino, 2005). Regret theory explains that when individuals consider decisions made, they experience regret when they presume a different option would have yielded better results (Zeelenberg, 1999), ultimately focusing them on the uncontrollable past rather than the more controllable future. A possible buffer against these deleterious effects may be mental toughness. To date, research on regret in sport is limited and no study has examined possible relationships between mental toughness and regrets. The current study, therefore, assessed relationships between mental toughness and regrets in 310 male (n=187) and female (n=123) Division I and II NCAA athletes. A previously established measure of mental toughness (MTS-Madrigal, Hamill, & Gill, 2013) was used, in addition to a newly created regret survey that captured the domains of relationships, sport behavior, cognitions, school behavior, life skills and health. At the end of their competitive season, athletes completed both the mental toughness and regret scales. Using Spearman's rho, mental toughness was negatively associated with all regret domains as well as total regrets experienced. These findings are significant because they suggest a positive approach to enhancing athletes' mindset by teaching skills of mental toughness. Suggestions for applying these findings will be discussed.

Perceived social support, parental expectations and goal orientations as predictors of adolescents' motives for participation in sport

Malete, Leapetswe, University of Botswana

The implication of social support, parental expectations and motivational orientations on the development of adaptive and maladaptive behaviors in youth sport is a topical issue in youth development today (Defreese & Smith, 2014; Stuntz &Weiss, 2010). This study examined the relationship among social support, parent expectations, goal orientations and motives for participation in sport among a sample of 985 Jamaican adolescents taking part in competitive and recreational sport. Participants completed the Task and Ego Orientation in Sport Questionnaire (Duda, 1989; Duda & Nicholls, 1992), the revised Sport Participation Questionnaire (SPQ; Ewing & Seefeldt, 1988), the revised Female Sport Socialization Questionnaire (Weiss & Knoppers, 1982), and the "What Do Your Parents Think Questionnaire" (Kimiecik, Horn & Shurin, 1996). For data reduction, an EFA was run on the SPQ yielding three factors with acceptable internal consistency (alpha ranged between .69 and .87). These related to competition and skill improvement, influence from others and intrinsic motives. Participants perceived greater support and influence from teachers and coaches followed by fathers and peers. Competitive sport participants perceived significantly higher parental expectations about their need to participate in sports than recreational sport participants. Perceptions of parents' desire to participate in sport (beta=.73) and improve sport skills (Beta=.48)

positively predicted competition and skill improvement motives for participation. Task (beta=.57) and ego (beta=.29) goal orientations positively predicted competition and skill improvement motives while only ego predicted influence from others (beta = .20). Task (beta = .22) positively predicted intrinsic motives. Findings support our understanding of the role of the social environment and goal orientations on adolescents' motives for participation in sport and participatory patterns. The results have implications for interventions and future research on positive youth development through sport and increased participation.—*University of the West Indies, Mona campus*

The effect of regulatory focus and message framing on constructing physical activity messages
Mantis, Konstantinos, Vazou, Spyridoula, Gentile, Doug, Iowa State University

Message framing (i.e., emphasis on gains or losses) has been identified as a strategy of promoting physical activity (PA). However, the results from existing literature are inconsistent. A potential explanation is the lack of fit between message content and message recipients' characteristics. So, the present study investigated whether promoters (i.e., people who try to achieve positive outcomes) would be persuaded more if there was a fit between message content and their motivational orientation (i.e., 'PA improves health' rather than 'PA decreases the risk of diseases'). The sample consisted of 142 undergraduate students (63 F; Mage=19.38; SDage=1.74) who were identified as promoters. The treatment design was 2 (Framing: gains/losses) x 3 (Priming: Mixed/Promotion/Prevention) full factorial. Baseline tests included measures of individuals' regulatory focus (i.e., type of motivation), attitudes, and intention to engage in PA. A message that emphasized gains or losses by using words that primed promotion, prevention or both regulatory foci followed immediately after. A post-test assessed attitudes and intention to engage in PA. There was a significant interaction effect between Framing and Priming, after controlling for pre-test attitude scores, F(2, 135)=3.834, p<.05, partial eta^2=.05. Participants' pre- test attitude scores, as a covariate, significantly predicted post-test attitude scores, F(1, 135)=631.227, p<.01, partial eta^2=.82. Gains were more effective than losses when they were presented in a mixed way while losses were more effective than gains when they were presented through words that primed only the promotion or the prevention regulatory focus. These results indicate that both gains and losses can affect individuals' attitudes toward PA under different conditions.

A randomized experiment testing the effect of tailoring messages to future time perspective on attitudes toward physical activity
Marien, Martina, Duncan, Lindsay R., McGill University

The socioemotional selectivity theory (SST) states that individuals with a more limited time perspective (e.g., older adults) are more likely to choose emotionally-meaningful goals, whereas those with an expansive time perspective (e.g., younger adults) tend to choose less emotionally-meaningful goals. The purpose of this study was to determine if physical activity (PA) promotion messages highlighting either more or less emotionally-meaningful goals would differentially impact attitudes toward exercise for individuals with different time perspectives. We recruited 59 younger adults (Mage=21.78, SD=2.39) and 99 older adults (Mage=73.66, SD=3.22) who were assigned randomly to view a 1.5-minute PA promotion video that highlighted either more or less emotionally-meaningful goals. We used multiple regression to assess the influence of message condition, future time perspective, previous PA and the interaction between message condition and future time perspective on attitudes toward PA after viewing the message. The overall model explained 19.8% of the variance in attitudes, F(4,137)=8.18, p<.001, with previous PA (beta=.905, p=.021) and the interaction between message condition and future time perspective (beta=.358, p<.001) each making unique contributions. Follow-up analyses indicated that among adults with a limited time perspective, only previous PA contributed to explaining attitudes (beta=.387, p=.001). However, both previous PA (beta=.326, p=.009) and message condition (beta=.278, p=.026) made significant unique contributions to the prediction of PA attitudes in adults with an expansive time perspective. Specifically, attitudes were more positive among individuals who saw the more-emotional (M=5.8, SD=1.08) compared to the less-emotional (M=5.32, SD=1.07) message. These findings fail to show that tailoring messages to future time perspective (in a manner consistent with SST) could be beneficial for changing attitudes towards exercise, however, more research needs to be done to assess SST impact on other outcomes related to PA.

Perceived groupness and belongingness in relation to social identity in youth sport

Martin, Luc J., Queen's University; Balderson, Daniel, Hawkins, Michael, University of Lethbridge; Wilson, Kathleen S., California State University Fullerton; Bruner, Mark W., Nipissing University

Social identity (SI) has garnered recent attention in sport research; however, much of the focus has been on the consequences emanating from identifying with a group. Indeed, SI influences perceptions of cohesion (De Backer et al., 2011), adherence to team goals (Tauber & Sassenberg, 2012), and prosocial teammate behaviours (Bruner et al., 2014). Interestingly, we have less of an understanding pertaining to the antecedents to SI. Recently, Bruner and colleagues (2015) demonstrated higher perceptions of team interdependence for achieving collective objectives (i.e., outcome interdependence) to predict greater identification with a group in youth sport. These preliminary results served as the basis for the current project, which sought to investigate potential contributing factors to perceptions of SI. Notably, two explanations for the outcome interdependence-SI relationship could be the extent to which athletes felt as though they were a team (i.e., groupness), or the satisfaction of an innate desire to be part of a team (i.e., belongingness). As such, the current project examined the influence of perceptions of groupness and belongingness in relation to SI in youth sport. In total, 480 athletes (Mage = 14.88, SD = 1.78, 266 females) from 31 high school sport teams (n = 14 basketball, n = 10 rugby, n = 4 football, n = 2 baseball, n = 1 volleyball) completed questionnaires (groupness, belongingness, SI) during their athletic season. Multilevel analyses indicated that at level one (i.e., individual level), groupness predicted ingroup ties ($b = 0.27$, $p < .001$) and ingroup affect ($b = 0.23$, $p < .001$), whereas belongingness did not. At level two (i.e., team level), team means for groupness predicted ingroup ties ($b = 0.50$, $p < .001$) and ingroup affect ($b = 0.33$, $p < .001$). Groupness and belongingness accounted for 20% (IGT) and 58% (IGA) of the overall variance, and the results suggest that the extent to which a group is perceived to be a group by members will ultimately influence perceptions of SI.—*Alberta Centre for Child, Family, and Community Research (ACCFCR)*

Characterizing exercise relationships: Communication, closeness, and performance

Max, Emery J., Wittenbaum, Gwen M., Feltz, Deborah L., Michigan State University

Group dynamics research in exercise has highlighted the motivation-boosting potential of working out with an exercise partner or group, but to the authors' knowledge there has been no research to date characterizing the typical exercise relationship, which is an interpersonal relationship that is rooted, to some degree, in an exercise context. A sample of 555 undergraduates were administered an 82- item survey, 383 of whom met inclusion criteria and reported having or having had an exercise partner. Participants (77%) reported that their exercise relationships typically emerged out of previously existing relationships. Participants reported (on a 1-7 Inclusion of Other in Self Scale) that they were very close with their exercise partners ($M = 5.07 + 1.56$) and that (out of 10 discussion topic categories) they talked about a number of topics outside of exercise ($M = 6.53 + 2.50$) and during typical workouts ($M = 4.21 + 2.69$). Exercise partners tended to discuss fewer topics when exercising compared to communication breadth outside of workouts, and this was especially true for closer exercise partners ($ps < .05$). Exercise relationships were characterized by mutual goal facilitation, and participants whose exercise relationships had dissolved or failed reported significantly lower interpersonal closeness, lower communication breadth, and more performance-based goals than participants who reported an ongoing exercise relationship ($ps <.05$). Participants exercised more often the more an exercise relationship was defined by exercise ($p < .05$), suggesting that exercise relationships that revolved around exercise were more immediately productive than exercise relationships that did not prioritize exercise. Future research should examine the development of exercise relationships over time, in a broader demographic, and the personality characteristics that may predispose one to favor or benefit from exercising with a partner versus individually.

Relationship between sleep quality, sleep duration and distributed attention performance in an athletic population

McCaffrey, Rob J., Dorsch, Kim, Mosiondz, Kyla, Harenberg, Sebastian, Neary, Patrick, University of Regina

Sleep has been identified as an important factor for the successful completion of various tasks. Self-reported sleep quality and self-reported frequency of sufficient sleep are among the main predictors of academic performance (Gomes & Tavares, 2011). Better sleep, in terms of sleep extension, has also been linked to an increase in athletic

(i.e., basketball) performance (Mah et al., 2011). Several studies have explored the impact sleep deprivation has on mood, cognitive performance, and motor function (Doran et al., 2001; Drummond, Gillin & Brown, 2001; Durmer & Dinges, 2005) however little attention has been given to the role sleep quality and duration play on distributed attention (DA) tasks in an athletic population. While a vast majority of studies exploring sleep related questions measured sleep over a longer period, this project explored sleep quality and duration the night preceding the administration of the DA task. One hundred and nineteen undergraduate Canadian Interuniversity Sport (CIS) athletes (female n=78) participated in the study. Each participant completed a demographic and background questionnaire. Next, participants reported their sleep duration (in hours and minutes) and sleep quality (1 Worst, 5 Average, 10 Best) from the previous night. Participants then completed a DA task using multiple object tracking (MOT) using Neurotracker software (Cognisens, Inc.). The performance (visual tracking speed) during the MOT session was recorded. Pearson correlation coefficients were calculated to examine the relationships between the constructs. Consistent with previous findings, sleep quality was positively correlated to performance on the MOT task ($r= 0.35$, $p<0.01$) however there was no significant relationship with sleep duration. These findings provide evidence that sleep quality is significantly related to DA in an athletic population. From an applied perspective, this study highlights the importance of sleep quality in athletic ventures that require DA. Future research is warranted to determine the effects of age, athletic ability, and sleep on DA.

Self-regulated learning for academic tasks: Do athletes engage regulatory processes more than non-athletes?
Mccardle, Lindsay, Hadwin, Allyson F., University of Victoria

High-level athletes demonstrate high achievement in academic settings and in sport (e.g., Aries, McCarthy, Salovey, & Banaji, 2004). One suggested reason for this concurrent success is that athletes engage self-regulatory processes that transfer into academic work (Jonker, Elferink-Gemer, & Visscher, 2009; McCardle, 2015). Self-regulated learning (SRL) refers to learners' proactive control of their cognition, behaviour, and motivation/affect in order to reach self-set goals (Winne & Hadwin, 1998). Indeed, athletes have self-reported higher engagement of SRL processes than age-matched non-athletes (Jonker et al., 2010, 2011). However, this line of research has employed a domain- general measure of SRL; thus, it remains unclear whether athletes' higher engagement of SRL processes is in sports, in academics, in a different domain, or across multiple domains. Because SRL is considered a process that unfolds in response to the task, challenge, and learners' goals, SRL can be considered context-specific and measurement should reflect this (Winne & Perry, 2000). Our purpose was to examine differences in athletes' and non-athletes' engagement of SRL in academic contexts. Competitive athletes ($n = 81$) and non-athletes ($n = 187$) responded to a context-specific measure of regulation, the Regulation of Learning Questionnaire (RLQ; McCardle & Hadwin, 2015). We ran a MANOVA with five RLQ subscales as the dependent variable and athlete/non-athlete as the independent variable. Analysis revealed no differences between engagement of SRL processes for athletes and non- athletes in an academic task, Pillai's trace = .035, $F(5, 261) = 1.87$, $p > .05$. Differences observed between athletes and non-athletes in prior research may have been related to how athletes engage SRL in sport rather than in academics. Thus, athletes might not regulate learning more than non-athletes in academic settings; additional research with a wider group of students and student-athletes is needed. Further, results highlight that measurement of SRL take into account the domain and learning context.

How social relationships and interpersonal training foster growth in physical activity programs for underserved youth: Staff perspectives
Mcdavid, Lindley, McDonough, Meghan H., Purdue University

In physical activity-based youth programs, positive social bonds between adult staff and youth are essential to fostering learning and growth (Benson et al, 2006). To leverage this association, staff need training on how to use evidence-based interpersonal styles to engage youth (Dubois et al., 2002). To this end, we developed a new basic needs theory (Deci & Ryan, 1991) based interpersonal training program, that increased the frequency of staff members' autonomy support and structure when working with youth in the program (McDavid, McDonough, & Blankenship, 2015). The purpose of this study was to examine staff perspectives on how their social relationships may enhance well-being in youth, and the utility and feasibility of the training intervention. Ten staff (7 women, 3 men; age 16-23 years) employed in a physical activity program for underserved youth were interviewed. N=7 staff had received the new training and three were part of a control group who received standard training. Constructivist

grounded theory was employed to examine staff experiences (Charmaz, 2008). Staff helped youth understand and apply program life skill lessons to improve their everyday lives, model prosocial behaviors, offer support and help with difficult life situations, and encourage youth to seek out new capacity-building experiences. Not all youth were receptive to their efforts, but staff believed attempts to build positive bonds should be made even with the most resistant youth as their interactions still had the potential to have a positive influence. Staff believed that the training program improved interpersonal skills essential to forging positive bonds, that learning principles of adaptive social relationships increased their ability to see how program experiences could lead to growth, and that they could apply the evidence-based interpersonal strategies to improve their relationships with youth. Findings emphasize the role of staff-youth social bonds in supporting well-being in youth and how staff interpersonal training can help establish these critical social connections.

Putting some culture back into culture change: Time to ask what culture is and not only what it can do for us
McDougall, Michael, Liverpool John Moores University

It is suggested that an expertise in culture change is becoming an increasingly important part of the modern day sport psychologists' repertoire (Cruickshank & Collins, 2013; Eubank, Nesti, & Cruickshank, 2014; Fletcher & Arnold, 2011; McDougall, Nesti, & Richardson, 2015). Accordingly, establishing a knowledge base within the academic literature that can suitably inform culture change practice is a key task facing all those responsible for the education and training of future sport psychologists (Cruickshank & Collins, 2013). Despite a number of notable advances in the area, a serious critique directed at some of this work is that it fails to really get to grips with and uncover issues that actually pertain to culture (Gilmore, 2013). Supporting this assessment, it is asserted that (a) culture change research to date has been change focused, rather than culture orientated; an approach that is contributing to a superficial understanding of culture and that is limiting the practical utility of culture change and (b) that it is time to ask what culture is, not just what it can do for us. To advance sport psychology conceptualizations of culture, a current definition of culture from within the sport psychology literature is examined and important, but largely neglected assumptions regarding the nature of culture are drawn out. These assumptions are then contrasted with alternative culture perspectives so as to further contribute to a broader and deeper understanding of culture that can inform future culture change research and applied practice.

Competitive team selection processes: The influence of Canada Summer Games selection status on athletes' cognitive appraisals and emotions
Mcewen, Carolyn E., Crocker, Peter R. E., The University of British Columbia

Athletes commonly identify team selection processes as a source of stress that could impact their quality of athletic engagement (Samuel & Tenenbaum, 2011) and affective experiences (Gaudreau et al., 2009). The purpose of this study was to examine the relationship between selection status (SS) associated with team selection and components of the stress process (e.g., emotion and cognitive appraisal; Lazarus, 1999). Employing a prospective-longitudinal design, competitive youth athletes vying for selection to the Canada Summer Games (CSG; nselected = 102; nnot selected = 35) completed measures of cognitive appraisal (Peacock & Wong, 1990) and emotion (Jones et al., 2005) prior to their final selection event, and one and five weeks after their selection status was known. Data were analyzed using multi-level modeling to examine a) the relationship between SS and intrapersonal change in the stress process and b) the association between SS and differences in athletes' stress processes after they became aware of their SS. Athletes' threat appraisals remained stable and intrapersonal differences in SS did not explain their appraisals ($p > .05$). However, selected athletes appraised the selection process to be more threatening than non-selected athletes ($\beta 01 = -.50$, $p < .01$). On average, athletes' challenge appraisals decreased ($\beta 10 = -.31$, $p < .05$) and intrapersonal selection was associated with challenge appraisals ($\beta 20 = .25$, $p < .05$). When athletes gained selected status they reported more control over the CSG tryout than non-selected athletes ($\beta 20 = .22$, $p < .05$; $\beta 01 = .41$, $p < .05$), while on average control appraisals decreased ($\beta 10 = -.20$, $p < .05$). SS was not related to athletes' centrality appraisals at the intra- or interpersonal levels. On average, athletes' feelings of dejection increased and feelings of happiness decreased after the CSG tryout and this effect was stronger for non-selected athletes ($p < .05$). Findings highlight the importance of investigating intrapersonal change and interpersonal athlete differences in relation to team selection events.

The coach-athlete relationship and athlete psychological health outcomes

McGee, Victoria, DeFreese, Jonathan D., Pietrosimone, Brian G., Myers, Joseph B., University of North Carolina

Athletes' experiences of relationships with their coaches have important implications for their psychological health and well-being (Poczwardowski et al., 2006). Accordingly, athlete perceptions of the coach-athlete relationship merit further examination as correlates of athlete experiences of burnout and engagement over time. The purpose of this study was to examine the association of athlete perceptions of the coach-athlete relationship with athlete burnout and engagement across a competitive season. We hypothesized that athlete endorsement of higher levels of markers of the coach-athlete relationship (i.e., closeness, commitment, complementarity) would be negatively associated with athlete burnout and positively associated with athlete engagement perceptions. Participants were female American collegiate rowers (N = 37; Mage = 19.3 years, SD = 1.18) who completed self-report assessments of study variables via computer interface at four in-season survey waves. A series of multilevel linear modeling analyses revealed the coach-athlete relationship marker of closeness to be a significant predictor of global engagement (fixed effect = 0.24, $p < .05$) but not global burnout. Significant between-athlete variation in the closeness–engagement relationship was also identified, suggesting the nature of this relationship is not universal to all athletes sampled. Commitment and complementary were not significant predictors of either athlete burnout or engagement when included in models with closeness. Study results substantiate the predictive impact of athlete perceptions of closeness with their coach to athlete engagement over the course of the competitive season. Correlational results further suggest the need for future examination of all markers of the coach-athlete relationship with perceptions of burnout and engagement in larger samples of both male and female athletes. Cumulatively, this work informs development of interventions designed to promote coach-athlete closeness as a means to enhance athlete engagement within competitive sport.

Using effort to inform cohesion in the youth sport setting

McLaren, Colin D., Spink, Kevin S., Ulvick, Jocelyn D., University of Saskatchewan

Perceived cohesion within a team has been positively associated with the effort adult athletes expend (Prapavessis & Carron, 1997). Recently, this relationship has been extended to a youth sport setting where a positive relationship was reported between perceived task cohesion and self- reported athlete effort (Ulvick, 2015). Although correlational, the assumption in these studies is that effort is a consequence of perceived cohesion. However, it also is plausible that perceptions of teammate's effort inform perceptions of team cohesiveness. For example, cohesion refers to individuals remaining united in the pursuit of the team's instrumental objectives. One assumed objective of sport is to win, and winning is more likely when all athletes expend maximal effort. As effort is a volitional resource, it might be assumed that individuals who perceive a greater number of teammates expending effort would perceive the team as being more cohesive. This was examined in this study. Youth soccer players from 10 teams (N = 121) completed a measure of effort and cohesion (YSEQ; Eys et al., 2009) toward the end of the season. To assess effort, individuals nominated teammates who demonstrated maximal effort. This generated two effort scores–outward effort nominations reflected the total number of teammates who the athlete perceived to give maximal effort and inward effort nominations reflected the total number of effort nominations an athlete received from other teammates. Canonical correlation analysis was used to examine the relationship between the set of effort (inward and outward nominations) and cohesion variables (task and social). Results revealed a significant canonical function ($p < .01$, $R2 = .15$), with task cohesion and outward effort nominations emerging as significantly related. As expected, findings revealed that individuals who perceived a greater number of teammates expending maximal effort also perceived the team to be higher in task cohesion. Of interest, no relationship emerged between perceptions of cohesion and athlete effort as nominated by other teammates.—*Social Sciences and Humanities Research Council of Canada*

Examining the cohesion/effort relationship: Effects of nominating versus being nominated for expending effort

McLaren, Colin D., Spink, Kevin S., Ulvick, Jocelyn D., University of Saskatchewan

Effort in sport has been operationalized in different ways. While athlete self- report has been used (Spink et al., 2013), this type of assessment could suffer from possible bias associated with issues such as self-presentation. One

alternative to self-report is the use of teammate identification of athlete effort. Interestingly, a recent study using this approach revealed mixed findings (McLaren et al, 2016). Perceptions of task cohesion were positively related to the number of teammates an individual nominated as expending maximal effort, but not to the number nominations the individual received from teammates. As this study examined nominations separately, we know less about these nominations relationally. For instance, do individual perceptions of cohesion differ if that individual nominates more teammates as expending effort than teammates nominate him/her" To explore this gap, recreational youth soccer players (N = 90, k = 8) completed measures of effort and task cohesion (YSEQ; Eys et al., 2009) at the end of the season. For effort, individuals nominated teammates who expended maximal effort and then were categorized in three separate groups: (1) those who received more nominations from teammates for expending maximal effort than the teammates they identified (n = 22), (2) those who nominated more teammates for expending maximal effort than they received from teammates (n = 30), and (3) those whose nominations of teammates for expending maximal effort matched the nominations they received from teammates (n = 38). A one-way ANOVA was conducted to test for differences in task cohesion between the three effort nomination conditions. Results revealed a significant effect of condition, $p < .01$, partial $\eta 2 = .13$, in which task cohesion was lower in condition (1) than in conditions (2) and (3), which did not differ. Perceived task cohesion was higher when individuals nominated more teammates for effort than they themselves were nominated, whereas it was lower for those who were recognized by others for effort, but who did not recognize other teammates themselves.—*Social Sciences and Humanities Research Council of Canada*

A longitudinal investigation of burnout levels in collegiate athletes: Exploring links with perceived coaching styles and behaviors

Mellano, Kathleen T., Michigan State University; Horn, Thelma S., Miami University

Research on burnout in collegiate athletes (e.g., Gould & Whitley, 2009; Holmberg & Sheridan, 2013; DeFreese & Smith, 2013) suggests low-to-moderate levels overall but considerable variability across individual athletes in their scores on the sub-dimensions. One factor that may impact burnout levels in college athletes is the type of leadership style and feedback behaviors they perceive their coaches to exhibit in practices and competitive events. The current longitudinally-based study was designed to: (a) examine if and how athletes' levels of burnout change from the beginning to the end of a competitive season; and to (b) determine if there is a predictive link between athletes' perceptions of their coaches' leadership styles and feedback behavior and changes that occur over the season in athletes' level of burnout. A sample of 126 collegiate female athletes completed self-report measures at two time-points (early and late season) to assess their burnout levels (ABQ) and their perceptions of their coaches' leadership styles and feedback behaviors (LSS, SCQ, CFQ). A repeated measures MANOVA revealed a significant time main effect for the sample as a whole, showing increases over the season in two of the three (reduced sense of accomplishment and sport devaluation) sub-dimensions of burnout. Hierarchical regression analyses indicated that perceived coaching behaviors (autonomy-support, type of feedback) explained end of season burnout scores above and beyond early season levels and perceptions of individual and team performance success. These results add to the growing body of literature on the utility of Self- Determination Theory as a framework for examining psychosocial health and well-being in collegiate athletes. In addition, the longitudinal nature of this study provides information regarding potential changes in the sub-dimensions of burnout over the season and in response to perceptions of coaches' behaviors.

Implicit red-dominance associations: Implications for sports behavior

Mentzel, Stijn, Schuecker, Linda, University of Muenster; Hagemann, Norbert, University Kassel

Wearing red gear can influence athletes' sports behavior and match outcomes (Hill & Barton, 2005). Similarly, jersey color can influence referee decisions, with players in red gear being favored in combat sports compared to players in blue (Hagemann et al., 2008). These findings have been attributed to an effect of the color red on perceived dominance. In this study we examined if the color red is implicitly linked to the concept of dominance and as a contrasting category if the color blue relates to rest, which has been suggested. To address this question, a modified Stroop word evaluation task was used. In a pilot study (N = 27) five dominance related words and five rest related words were selected, out of a total of 27 (German) lexical words from the Berlin Affective Word List Reloaded (BAWL-R), based on their average rating as being either dominant or rest related. For the main study these ten words were presented in either blue, grey or red on a color calibrated screen to 30 participants (23.07 SD

4.42 years), who where asked to indicate the words shown as being either dominant or rest related. The responses were recorded and analysed for reaction time and accuracy. The results showed a significant interaction effect for color and word type on reaction time, $F(2, 56) = 5.09$, $p = .009$, $\eta p2 = .15$. Participants showed on average shorter reaction times for categorising dominance words in red, compared to blue and grey and quicker responses for rest related words in blue and grey. Similar findings were shown for the accuracy, $F(1.614, 45.193) = 8.57$, $p = .001$, $\eta p2 = .23$. The measured effects suggest that there is an implicit red- dominance association, as well as a red-rest disassociation. We theorize that this association can affect sports behavior, with red gear triggering a dominant behavioral response, possibly both in athletes themselves as well as observers perceiving them as more dominant irrespective of actual behavior. Future research should investigate this effect in sport-specific situations with a more behavioral dependent research design.

Understanding the effects of message framing on physical activity action planning: The role of risk perception and elaboration.

Michalovic, Emilie, McGill University; Hall, Sarah, York University; Duncan, Lindsay R., McGill University; Basset-Gunter, Rebecca, York University; Sweet, Shane N., McGill University

Action planning (AP) is a self- regulatory technique which can help individuals improve their physical activity levels. Messaging strategies, such as message framing, have shown limited success in promoting AP. However, potential mediating and moderating variables have yet to be examined to further understand how message framing and messaging strategies may be improved to promote AP. The purpose of this study was to examine message elaboration as a mediator and risk perception as a moderator of the message frame-AP relationship. 180 adults (56% male, mean age 29.7 (SD=9.92)) completed an online questionnaire. Participants were assigned randomly to read a gain-framed (n=98) or a loss- framed (n=82) AP message. They responded to questions about their perceived emotional risk of AP (i.e., if creating an AP will increase their sense of failure) pre- and post-message as well as their elaboration (i.e., how deeply the message made them think, or think rather than feel) post-message. Using the PROCESS macro for SPSS, mediation analysis were conducted to examine elaboration as a mediator of the message frame-AP relationship. Moderation analyses were calculated with risk perception as a moderator of the message frame-AP relationship. The overall mediation model was not significant but elaboration significantly predicted AP [b=0.37, 95% confidence intervals (CI): 0.076, 0.67]. Moderation analyses showed that perceived emotional risk of AP was a significant moderator of the message frame-AP relationship [odds ratio (OR)=0.51, 95%CI: 0.27, 0.96. Post-hoc analyses showed emotional risk only had a significant relationship with gain-framed messages [OR=1.78, 95%CI: 1.09, 2.89]. Greater message elaboration was associated with increased likelihood of creating an action plan. As well, gain-framed messages may be more effective at promoting AP when individuals report more emotional risk. Message elaboration and emotional risk may be important factors involved in encouraging individuals to create physical activity action plan.

Neural correlates of choking under pressure: A high-resolution fMRI study

Miller, Matthew, Lohse, Keith R., Grand, Kirk F., Robinson, Jennifer L., Auburn University

It is well-known that individuals often perform worse under high psychological pressure than low pressure. Colloquially, this phenomenon is known as "choking" under pressure. Although there is considerable behavioral research into choking, the neurophysiological correlates of choking are less well-understood. In the present study, we explored the neural correlates of choking under pressure in an isomeric force production task. Twelve participants performed a grip force task in a 7T fMRI (Siemens Magnetom). Force, electrocardiographic, and electromyographic data were recorded using a Biopac MP150. Participants practiced squeezing a dynamometer with their dominant right hand to produce 30% of their maximal force and then attempted to produce the target force under conditions of low and high psychological pressure, which were counterbalanced with respect to order. In the low pressure condition, participants were instructed to do their best. In the high pressure condition, participants were told they were teamed with a partner who had previously completed the experiment. Participants were told they and their partner both had to improve upon their practice performance in order to earn $50 each. Participants were told their partner had already succeeded, so it was up to the participant to succeed in order to earn the money for both people. Behaviorally, participants produced less accurate force under high pressure in comparison to low pressure ($p = .01$), demonstrating a choking effect. Neurophysiologically, high pressure was reliably associated with increased

activation in the cingulate cortex and activity in a fronto-parietal network (all neuroimaging results thresholded at $p < .05$, multiple comparison corrected). Therefore, the choking effect occurred concomitant with recruitment of brain regions associated with error monitoring and attentional control.

How does integrated regulation contribute to physical activity maintenance?

Miquelon, Paule, UQTR; Castonguay, Alexandre, University of Quebec

Maintenance of physical activity (PA) is an important research agenda. Using self-determination theory (Deci & Ryan, 2000), the aim of this study was to verify how integrated regulation (INTEG) contributes to PA maintenance. A two-wave prospective design was used and 864 adults (791 or 91.6% women, M age = 35.33, SD = 11.52) participated in the study. At Baseline (T1), participants completed the Behavioral Regulations in Exercise Questionnaire-2 (Markland & Tobin, 2004), an INTEG scale (McLachlan, Spray, & Hagger, 2011), and a questionnaire assessing their PA behavior (Godin & Sheppard, 1985). Three months later (T2), PA behavior was reevaluated and participants also completed the stage of change in exercise questionnaire (Marcus, Selby, Niaura, & Rossi, 1992). Results of hierarchical regressions first showed that, once having controlled for T1 PA behavior, INTEG was the sole significant predictor of T2 PA behavior (i.e., PA intensity, frequency, and duration) (all $p < 0.016$). Then, a MANCOVA was conducted to examine if the effect of INTEG on PA behavior maintenance could be explained by the regularity of PA practice. Participants were divided in two groups: those who indicated they had regularly practiced moderate to vigorous PA three times/week since at least three months and those who indicated they had not. Results revealed significant effect of PA motives on PA groups [$F (5, 362) = 7.51$, $p < .01$; Pillai's Trace = 0.94] and post-hoc tests indicated significant differences on all motivation types, except introjected regulation. However, results showed that the mean difference found for INTEG (2.758 vs 1.53, $\Delta = -1.228$, $p < .001$) was larger (at a minimum twice as much) than the one associated with all others forms of motivation. Moreover, in addition of suggesting a large effect size, the Cohen's d associated with INTEG ($d = -1.048$) was also larger than the one found for the other types of motivation. These findings highlight the importance of considering the role of INTEG when it comes to PA maintenance and its privileged relationship with PA regularity.

Body image and psychological functioning in collegiate cheerleaders

Monsma, Eva V., University of South Carolina; Gay, Jennifer L., University of Georgia; Torres-McGehee, Toni, University of South Carolina

This study examined body image correlates of disordered eating and depression among cheerleaders accounting for biological characteristic and task demand constraints associated with cheerleading position. Female collegiate cheerleaders (N = 243) completed a battery of surveys including: current and ideal clothing-based body image ratings (i.e., daily clothing, midriff and full uniform), ratings relative to meta- perceptions (i.e., perspectives of parents, friends and coaches) the SPAS, EAT-26 and CES-D. Overall, this sample of cheerleaders were at approximately the 30th percentile for height (M = 160.31 + 7.11 cm) and approximately at the 50th for weight (M = 58.93 + 10.09 kg) and BMI (M = 22.03 + 2.91). Age at menarche ranged from 8 to 17 (M = 12.99 + 1.59) whereas mother's age at menarche ranged from 9 to 19 (n = 206, M = 13.35 + 1.71). The overall prevalence of disordered eating was 25.5% (95% CI=5.48, 20.02 to 30.98) and by position, (base: 28.3%; flyers: 23.6% and back spots: 25.8%, p = .75). Depression prevalence based on CES-D scores > 16 was 28.5% + 5.69 (95% CI: 22.81% to 34.19%) and by position, (base: 30.0%; flyers: 27.5% and back spots: 27.9%, p = .92). For body image dissatisfaction, all ideal body images were significantly smaller than current body images. Compared to bases and back spots, flyers, who were significantly shorter, lighter, had a lower BMI and were later maturing, reported less dissatisfaction related to daily clothing and from the perspective of parents and friends. After controlling for BMI (4%), stepwise regression analyses indicated midriff uniform dissatisfaction (32%), social physique anxiety (SPA) (6%) and parent meta-perception discrepancy (2%) predicted disordered eating risk while depression risk was predicted by SPA (19.1%) and coach meta-perception discrepancy (5.6%). Specific focal points for social agents and sport governing bodies are offered with the goal of enhancing recognition, opportunities and resources for the future of cheerleading.

The association between a priori learning disorders and concussion outcomes
Moore, Robert D., Sicard, Veronik, Ellemberg, Dave, University of Montreal

Accumulating evidence suggests that a significant portion of athletes will experience persistent neurophysiological and neuropsychological alterations following a concussion. Further, emerging research suggests that a priori conditions may be key factors moderating injury outcomes. To evaluate the relation between learning disorders (LD) and concussion outcomes. Seventy-seven university athletes (24 concussed w/out LD, 24 concussed w/ LD, 26 controls), who reported to be symptom free participated in this study. Athletes with a history of concussion were ~ 1 year from injury (range: 6 months - 2 years). Tests included an oddball task during which event-related brain potentials (ERPs) were recorded, a modified CogState battery, the Beck Depression Inventory-2 (BDI-II), and the Profile of Mood States (POMS). ERPs: Concussed athletes w/ LD exhibited prolonged P3 latency, indicative of delayed information processing, relative to concussed athletes w/out LD and controls. Irrespective of LD, concussed athletes exhibited decreased ERN and Pe amplitudes relative to controls, indicative of deficits in action monitoring (ERN) and error awareness (Pe). CogState: Concussed athletes w/ LD exhibited decreased accuracy on the Card Learning Task and the N-back Task relative to controls, indicative of deficits in learning and memory. No significant differences were observed between concussed athletes w/out LD and any other group. BDI-II: Concussed athletes w/ LD exhibited greater depressive symptoms in than to controls, but concussed athletes w/out LD did not differ from any other group. POMS: Concussed athletes w/ LD exhibited greater tension-anxiety, anger-hostility and overall mood disturbance than controls. Further, concussed athletes w/ out LD exhibited increased anger-hostility than controls. Conclusion- Having LD may be a significant factor moderating the neurophysiological, cognitive and psycho- affective outcomes of concussion, and may explain a significant portion of the persistent deficits observed by researchers and clinicians.—*Canadian Institute of Health Research*

The association between learning disabilities and concussion incidence in young adults: A retrospective and prospective study
Moore, Robert D., Paga, Linda S., Ellemberg, Dave, University of Montreal

Concussive injuries are an increasing public health concern. Although considerable research efforts are dedicated towards understanding injury outcomes, less effort is devoted to understanding the risk factors of injury. Purpose: To retrospectively and prospectively evaluate the relation between neurodevelopmental disorders and the risk of incurring concussive injuries. Methods: 148 University athletes completed baseline testing, which included the assessment of learning disabilities and sport-related concussion. Odds ratios were calculated ((pa/1-pa)/(pb/1-pb)) for the 148 athletes who completed the baseline assessment and for the 48 athletes who incurred a concussion during the study. Results: At baseline, 32 athletes had a history of one concussion and 59 athletes had a history of two or more concussions. Athletes with a learning disability were 2.06 times more likely to have a have a history of concussion and 1.63 times more likely to have a history of multiple concussions than those without a learning disability. Further, athletes with a learning disability were 2.62 times more likely to suffer a concussion during the course of the study than athletes without a learning disability. The current data suggest that having a learning disability may be a significant risk factor for incurring a concussive injury.—*Canadian Institutes of Health Research*

From the cricketers' perspectives: Experiences of a 21 day mindfulness training program.
Mosewich, Amber D., University of Alberta; Immink, Maarten A., University of South Australia; McGregor, Matthew, South Australian Cricket Association

The application of mindfulness in competitive sport is gaining increased attention both in applied and research settings (Birrer et al., 2012). However, sport-specific program development and evaluation is ongoing, and questions remain around the best way to introduce mindfulness to athletes. There is also limited understanding of athletes' experiences with initial mindfulness training. The purpose of this study was to evaluate the effectiveness, strengths, and limitations of a mindfulness training program, from the perspectives of the end user - male cricketers. An additional focus was to explore male athletes' understanding of mindfulness and their openness to concepts connected to self-compassion and mindfulness. Three focus groups (3-6 athletes / group) were held upon completion of a 21 day mindfulness program. A constant comparison approach (Corbin & Strauss, 2008) provided a framework for analysis of focus group data (Onwuegbuzie et al., 2009). Athletes perceived mindfulness as useful in sport,

particularly for game- and self-awareness, attention, and emotion regulation, though all experienced barriers to mindfulness practice, which included scheduling, accessibility, and commitment challenges. Additional barriers offered as reasons for low adherence included frustration with building skills and concern over missing sessions, as athletes assumed potential benefit would be negated. Athletes' suggestions for improved adherence and usability in the future included further application examples to enhance relatability and development of strategies to manage barriers, including increased involvement from support staff and alternative options for engagement. An understanding and acceptance of mindfulness and self-compassion concepts were expressed by the cricketers, who felt such ideas were mostly supported in the cricket context. Taken together, the challenge was less about resistance to the concepts and more about relatability. Concepts and skills must be introduced in a way that is accessible to athletes and the context in which they participate.—*University of South Australia*

How do elite youth soccer players generate options in a time-pressured task? Preliminary results of a longitudinal study on the development of decision-making

Musculus, Lisa, German Sport University Cologne, Institute of Psychology; Lobinger, Babett, Raab, Markus, German Sport University Cologne

In sport decision-making strategies like the Take-the-First heuristic (TTF), which describes that the first, intuitive option generated is of highest quality and should be selected, can differentiate between expertise groups. However, little is known on how youth athletes develop their decision-making skills. Therefore, this longitudinal study (t1"t4, six month intervals) focuses on how decision-making develop by testing whether the TTF holds for the decision-making process of elite youth soccer players. In a within-subject experiment applying a temporal occlusion paradigm, 97 players in the age of 6-13 years generate options with and without time-pressure by marking them on a touch-pad. Results of t1 showed players generated less options under time-pressure compared to no time-pressure, F(1,95)=8.513, p=.004, part.Eta2=.08. Players selected their first option to be the best, according to TTF, more frequently in the time-pressure condition, Chi"(1,N=97)=11.60, p=.001. Furthermore, the players' mismatch between the first intuitive and final choice, so called dynamic inconsistencies, were apparent in 22% of the decisions made with and 29% of the decisions made without time-pressure. Dynamic inconsistent decision-making behavior was predicted by the total numbers of options generated in the time-pressure, β=.58, t(95)=6.95, p<.001, R2=.33, as well as in the no time-pressure condition, β=.45, t(95)=4.88, p<.001, R2=.19. This pattern of results hints at pressure boosting the effect that generating more options made players trust less in their first option. This might be a disadvantage because the first option has been shown to be of higher quality. Furthermore results regarding dynamic inconsistency rates hint at differences between adults and adolescents indicating this process to be influenced by developmental changes. To further understand these developmental changes of elite players' cognitive processes, theoretical implications regarding decision-making process development will be discussed by taking additional study results (t2) and state-of-the-art into account.—*Studienstiftung des deutschen Volkes*

Measuring multidimensional subjective well-being with the I COPPE scale in a Hispanic sample

Myers, Nicholas D., Park, Sung Eun, Lefevor, Gary T., Dietz, Samantha, Prilleltensky, Isaac, Prado, Guillermo J., University of Miami

The purpose of this study was to provide initial validity evidence for measuring multidimensional subjective well-being in a Hispanic sample with the I COPPE Scale. Accomplishing this purpose was important for at least two reasons. First, there is evidence that each of the dimensions of well-being purportedly measured by the I COPPE Scale (except for economic), interpersonal, community, occupational, physical, psychological, economic (i.e., I COPPE) and overall, is relevant within the study of human movement. Second, the Hispanic population is a population for which use of the I COPPE Scale is intended, due to related health disparities in the Hispanic population, but for which validity evidence does not yet exist. Participants were 641 English- speaking adults who self-identified as Hispanic and resided in the United States. Bi-factor analyses were used to evaluate (a) the a priori measurement theory for responses to the I COPPE Scale and (b) convergent relationships of the seven I COPPE subjective well-being factors with scores from established comparison instruments. There was evidence that (a) the a priori hypothesized measurement theory for responses to the ICOPPE scale emerged in an exploratory bi-factor analysis and (b) the I COPPE subjective well-being factors exhibited convergent relationships with scores from established comparison instruments. Use of the I COPPE Scale to derive multidimensional measures of subjective

well-being may be of potential utility to future research in the interdisciplinary study of human movement and in a diversity of populations in which health disparities may exist.—*Miami Clinical and Translational Science Institute*

A retrospective exploration of sibling relationships in elite youth sport: Perceptions of the parental role
Nelson, Kendra, University of Western Ontario; Strachan, Leisha, University of Manitoba

Parents have the potential to influence sibling relationships in sport (C"t" & Fraser-Thomas, 2011; Fraser-Thomas et al., 2013). When parents provide equal opportunities, experiences, and support, siblings tend to have a more positive sport experience and sibling relationship. However, if an uneven distribution of resources is experienced, tension and jealousy can arise among siblings leading to negative outcomes (i.e., pressure, loss of confidence) (C"t", 1999; Nelson, 2015; Strachan et al., in press; Sulloway, 1996). Research investigating youth athletes' perception of the parental role is relatively scarce and research in this area could contribute to sustained positive sport participation and development as well as positive sibling relationships. The aim of the study was to explore how parents influence the sibling relationship in youth sport. Using a grounded theory and retrospective approach, semi-structured interviews were conducted with previously identified elite youth sibling-athletes (N=10: 5 sets of siblings from hockey, ringette, volleyball, and soccer). Data analysis uncovered three main themes: parental support (e.g., understand experiences, mental and tangible support), influence on skill development (e.g., sport-related feedback, instilling motivation and responsibility), and negative influence of the parent (e.g., having to prove self, pressure, frustration). The data adds to the probable parent experiences proposed in the Developmental Model of Sport Participation (Fraser- Thomas et al., 2013) and provides insight and suggestions for parents on how to best manage sibling relations in sport. For example, results imply that if parents are mindful of the distribution of resources, provide equal support, maintain open communication, avoid discussing comparisons between siblings, and provide a wide variety of opportunities during the specializing years, sibling-athletes may experience less jealously and tension.

Mental fatigue, achievement motivation and their impact on sprint start reaction time
Nieuwenhuys, Arne, Radboud University; Koedijker, Johan, VU University

Recent studies suggest that mental fatigue may significantly impact sprint start reaction time (Englert & Bertrams, 2014; Englert et al., 2015). In contrast, other literature suggests that negative effects of fatigue may be compensated for as long as individuals are sufficiently motivated to perform well (Hockey, 2013). Upon these premises, the current study set out to (1) replicate the findings of Englert and colleagues; and (2) extend this body of work by investigating how achievement motivation impacts the relation between mental fatigue and sprint start reaction time. Using a pretest-posttest design, 40 physically active individuals (out of a to-be-tested sample of n = 120) performed two series of three 20-meter maximal effort sprints. Sprint start reaction times (in milliseconds) were measured following official IAAF regulations using an instrumented starting block. Between pretest and posttest, mental fatigue was manipulated (between subjects) using a letter transcription task (low vs. high complexity). Achievement motivation was manipulated (between subjects) by offering half of the participants a 10" monetary reward in case they improved their pretest performance. Manipulation checks were taken immediately after the transcription task (mental fatigue " 4 items) and before starting the pretest and posttest (achievement motivation " 1 item). Preliminary analyses indicate that the transcription task and monetary rewards reliably increased mental fatigue and achievement motivation, with $F(4,33) = 10.31$, $p < .001$ and $F(1,36) = 4.51$, $p = .041$, respectively. However, no significant main effects or interactions were observed for sprint start reaction time ($Fs < 1$. $ps > .33$). Despite careful replication of procedures, we were unable to reproduce earlier observations by Englert and colleagues (Englert & Bertrams, 2014; Englert et al., 2015). Theoretically, the absence of a performance effect in our study may be explained by high baseline levels of achievement motivation. Analysis of the complete sample is necessary to substantiate this conclusion.

Exergamers' preferences and intentions

O'Loughlin, Erin K., Concordia; Scarapicchia, Tanya, Toronto; kakinami, Lisa, Barnett, Tracie, Concordia; Sabiston, Catherine M., Toronto

Research on exergaming is accumulating, but little is known about users' preferences or intentions of exergaming behaviours in a natural environment (non- intervention setting). Insight into these aspects is important for game developers in order to better tailor games to users' needs and expectations, as well as from a public health perspective. Specifically more evidence is needed on if and how exergames can increase physical activity participation. However, there are no reliable self-report measures of exergamer preferences or intentions. In this project, we examined the test retest reliability of the EXPAI-9 (a 9-item likert scale on preferences and intentions regarding exergaming (e.g. I prefer exergaming over participating in outdoor sports)) among past-year exergamers (n=40) age 19 years on average (64% female). Participants completed the EXPAI-9 through self-report in September 2015 and completed a retest one month later. Twenty-four percent of participants reported playing exergames 1-6 times per month in the last year using consoles and 34% used mobile devices. Individual items exhibited fair to good stability (intraclass correlation coefficient ranging from 0.338 to 0.760). Overall the EXPAI-9 items were relatively stable over one month. Future research should test the reliability of the EXPAI-9 in larger more diverse samples, and examine exergaming behaviour in relation to the EXPAI-9 score over time.

The relationship between physical activity and quality of life among Korean immigrants

Oh, Eungwang, Jang, Jungyun, Gill, Diane, University of North Carollina, Greensboro

Considerable research indicates that physical activity (PA) is related to Quality of life (QoL) in diverse populations. This study extends that research to a different cultural context. Adult Korean immigrants living in the U.S. (n = 201; male = 86, female = 115; age 18-72, M = 42.2, SD=14.66) completed surveys including the Gill et al. (2011) Quality of Life Survey with 7 sub- scales (physical, functional/ADL, emotional, cognitive, social, spiritual, integrated), Diener et al.'s (1985) Satisfaction with Life Scale (SWLS), the Godin (1985) measure of PA, stage of exercise measure and open-ended question (how does PA affect your QoL"). Our primary analyses were correlations of PA (Godin total METS) with QoL and SWLS, and MANOVA comparing 3 groups based on exercise stage (n = 91 in action-maintenance; n = 48 in preparation, n = 60 in precontemplation-contemplation) on QoL and SWLS scores. Only physical QoL (r = .30) and functional/ADL (r = .18) were significantly correlated with PA. MANOVA revealed a significant difference on QoL dimensions, $F(14, 380) = 2.25$, $p < .01$; Wilks' $\lambda = .85$; partial $\eta 2 = .08$. Participants in the action-maintenance stage (M = 16.96, SD = 3.09) had significantly higher physical QoL than participants in precontemplation- contemplation (M = 14.73, SD = 3.59, $p < .001$), with the preparation group falling in between (M =15.73, SD = 3.03). Open-ended responses revealed that participants clearly viewed PA as enhancing quality of life; 80 (35%) were simply coded as positive (good, positive); most other responses matched the QoL dimensions with 8% physical (health, weight, fitness), 18% emotional (vigor, mood, happiness, stress relief), and a few (2-5%) cognitive, social, and spiritual. Only 2% of responses were negative (tired, unfit). Although only physical QoL had a statistically significant relationship to PA, open- ended responses suggested PA affects all dimensions. The results suggest that, much like other samples, Korean immigrants clearly see PA as enhancing their overall quality of life.

Effects of an 8-week aerobic exercise intervention on attention and cognitive control in major depressive disorder

Olson, Ryan L., Brush, Christopher J., Ehmann, Peter J., Alderman, Brandon L., Rutgers University

Major depressive disorder (MDD) is characterized by a number of behavioral, emotional, and cognitive symptoms, including an inability to focus, concentrate, or sustain attention. Despite the evidence base supporting traditional treatments for depressive symptoms, there remains a need to investigate empirically-validated approaches aimed at improving cognitive deficits in depression. Although aerobic exercise (AE) has demonstrated efficacy in the prevention and treatment of depression and for enhancing cognition, little is known about its potential for improving cognitive deficits in MDD, and whether these improvements are related to symptom reduction. The aim of this study was to examine the effects of an AE intervention on cognitive function and depressive symptoms in individuals with a clinical diagnosis of MDD. 32 participants (19.9 SD 1.3 years) met the inclusion criteria and were randomly

assigned to 8 weeks of moderate-intensity AE or a control group of light stretching. AE and stretching groups consisted of three weekly 30-45 min sessions per week. Depressive symptoms (BDI), peak aerobic fitness (VO2 peak), and cognitive performance were assessed at baseline and follow-up. Attention and inhibitory cognitive control were assessed through an attentional blink (AB) paradigm and a modified incompatible flanker (ICF) task. Individuals with MDD who completed 8 weeks of AE (n = 24) showed significant reductions in depressive symptoms ($p < 0.05$, $\eta 2p = 0.47$) without a change in aerobic capacity ($p = 0.14$, $\eta 2p = 0.32$) from pre-to-post intervention. Significant improvements in reaction time emerged for the ICF task following AE ($p < 0.05$, $\eta 2p = 0.53$), although no change in accuracy was observed ($p > 0.05$). Improvement in reaction time covaried with level of change in depressive symptoms, $p < .05$. No significant effects were found for the AB task. These findings indicate that an 8-week AE program improves inhibitory cognitive control and reduces symptoms of depression. These benefits occurred without a change in fitness, suggesting other mechanisms of action.

A pilot study of physical activity behavioral counseling for students seeking mental health support: Feasibility and mental health benefits.

Omran, Janine, Howe, Holly, Sabiston, Catherine, University of Toronto; Faulkner, Guy E., University of British Columbia

To establish the feasibility of a physical activity (PA) behavioral counselling intervention on changes in mental health outcomes and PA in a sample of university students seeking mental health support. A pre-post single group. Inactive healthy weight female university students (Mean Age=22, SD=6.1 years; Mean BMI=22, SD=4.2 kg/m2) seeking mental health support from university health services recruited through program recommendation/ referral by a physician. Six-week PA behavioral counselling program consisting of weekly 30 minute one-on-one sessions with a PA counsellor focusing on PA behaviour change techniques (i.e., goal-setting, self-monitoring, action planning, etc.) and a supervised exercise session. Additionally, participants were asked to exercise on their own to reach PA guidelines of 150 minutes/week. Participants completed a self-report questionnaire assessing PA and mental health at baseline and again including a program perception survey following intervention completion. Descriptive statistics to depict change in mental health and PA outcome measure scores. Answers from the post-intervention program perception survey were collated and presented as summary statements. All participants had higher scores for psychological wellbeing and overall psychological distress, anxiety and loss of control scores were significantly reduced at post-intervention compared to baseline. An increase in Median METs per week was also observed and participants reported high program satisfaction with no adverse program effects. The PA behavioral counselling program was feasible, safe and effective in reducing psychological distress scores over the relatively short 6-week intervention time period. Results of this study provide preliminary evidence for the feasibility of providing immediate referral to a PA behavior counselling program for students seeking mental health support, especially in the case where medication is inappropriate or where long wait lists for treatment exist.—*Faculty Internal Research Grant*

Moving with technology: Adapting a telephone-based physical activity counselling service for adults with disabilities

Orr, Krystn, Arbour-Nicitopoulos, Kelly P., University of Toronto; Tomasone, Jennifer R., Latimer-Cheung, Amy E., Queen's University; Martin Ginis, Kathleen A., McMaster University

In 2008 Get In Motion (GIM), a free telephone-based physical activity (PA) counselling service for Canadian adults with spinal cord injury was developed by SCI Action Canada. GIM expanded its service in 2014 to also include adults with multiple sclerosis (MS) and cerebral palsy (CP), with the possibility of a future rollout to other disability groups such as visual impairment. To provide the highest quality of service, it was important that the GIM team further explored the barriers and facilitators to technology-based counselling, previous experiences with PA participation, and use of technology among these future intended users. To do so, eleven telephone and face-to- face interviews were conducted with physically active individuals (aged 18+ years) with MS, CP or visual impairments. A data-driven thematic analysis (Braun & Clarke, 2006) was conducted. Participants had varied PA backgrounds but were active at the time of the interview. Key themes expressed included accessibility, technology as a PA information tool, peer and social support, and positive PA experiences. Participants provided suggestions for improving accessibility within programs and facilities. Among participants with visual impairments online resource

accessibility was discussed with suggestions made for formatting, colour contrasts, and text size. All participants described the increasing use of technology for health and fitness information, but remained cautious of the authenticity of the content. PA participation was discussed as a coping tool for the losses experienced following diagnosis among individuals with MS and visual impairment. Finally, participants expressed the importance of having support from family, friends, and peers for their continued PA participation. The findings from this study will inform GIM counsellors on how to best provide positive PA experiences through technology-mediated counselling to adults with MS, CP, or visual impairment. Other organizations and facilities can benefit from the suggestions made to improving their physical, social, and online accessibility.

Interpersonal emotion regulation in a high performance volleyball team

Palmateer, Tess M., Tamminen, Katherine A., University of Toronto

Past research has started to examine emotions and emotion regulation from an interpersonal perspective (e.g., Tamminen & Crocker, 2013), but little is known about the ways in which teammate relationships, roles, preferences for interpersonal emotion regulation, and other factors may influence emotion regulation within teams. Therefore, the purpose of the present study was to better understand interpersonal emotion regulation (IER) and the factors that influence IER within a high performance female varsity volleyball team by using an instrumental case study (Stake, 1995). Sixteen athletes were invited to take part in two individual semi-structured interviews (early- and late-season). The participants ranged from first to fifth year of eligibility and played a variety of positions. The interviews consisted of questions regarding teammate relationships, emotions, IER, and preferences for IER. Content analysis was used to identify, code, and categorize patterns within the data (Mayan, 2009). Athletes described examples of intentional IER strategies such as making a connection and providing positive support, and athletes also indicated that some habitual, automatic interactions between teammates also served to regulate their emotions. In addition, each athlete explained their personal preferences for having their emotions regulated by teammates. These preferences included having teammates help them stay calm and focused as well refraining from putting emphasis on performance mistakes. Most athletes reported that IER could come from any teammate since they have had similar experiences and understand the intricacies of the sport. The factors that influenced IER were athletes' roles and position, social norms within the team, and the specific context of volleyball. The results of this study could lead to interventions to help athletes regulate their own and others' emotions in sport, however further research is needed to understand how IER differs across various sport contexts.

Investigating the effects of high-intensity interval training on inflammation and depression in young adults.

Paolucci, Emily M., Heisz, Jennifer J., McMaster University

Depression is experienced by approximately eight percent of all adults at some point in across their lives, with particularly high rates during young adulthood. There is an urgent need to understand the factors that reduce negative mood. Depressed mood is associated with high levels of inflammation. Given that exercise improves mood and regulates the immune system, it was hypothesized that exercise may reduce inflammation to improve mood, however it was unclear which exercise intensity would be most effective. Fifty-six participants were assigned to one of three groups: 1) High-intensity 2) Moderate-intensity and 3) Non-exercise control. The exercise groups underwent training three times per week for six weeks. Aerobic fitness, depression, and inflammatory cytokine (IL-6, IL1-B, TNF-a) levels were measured before and after the 6-week intervention. It was found that both high and moderate intensity exercise protected students against depression as indicated by a significant increase in depression for the control group ($p< 0.01$) that was not observed for the exercise groups. Inflammatory factors TNF-a and IL-6 decreased more for the moderate intensity group than the control group (both $p< 0.05$), however inflammation did not decrease for the high-intensity exercise group. The results suggest that exercise may help to mitigate depressed mood in young adults through reductions in inflammation but only at moderate intensities.

The Effects of Memory Style and Motor Experience on Action Memory

Peng, Jie Yu, Shanghai University of Sport; Zhu, Qin, University of Wyoming; Li, Anmin, Shanghai University of Sport

Previous studies (Engelkamp et al., 1994 & 2000) have suggested that action memory is better with actions being self-performed rather than being verbally/visually presented. In the current study, action memory of full-body movements was investigated with consideration of both memory style and motor experience. 40 athletes and 40 non-athletes were recruited, and then randomly divided into half to remember the action materials either by self-performing the task (SPT) or by observing the task (OT). Two memory tests (recognition and free-recall) were administered immediately after the remembering part, and then again on the second and seventh day afterwards. The recognition test showed significant main effects for motor expertise ($F_{1,76} = 7.78$, $p<0.01$), memory style ($F_{1,76} = 12.08$, $p<0.01$) and passage of time ($F_{2,152} = 61.42$, $p<0.001$) without any interaction detected among them. There was a significant drop of sensitivity from day 1 to day 2 ($p<0.05$) without much drop occurred from day 2 to day 7 ($p>0.05$). The free-recall test showed significant main effects for motor expertise ($F_{1,76} = 72.06$, $p<0.001$), memory style ($F_{1,76} = 52.60$, $p<0.001$) and passage of time ($F_{2,152} = 3.78$, $p<0.05$), however, there was a significant interaction between the motor expertise and memory style ($F_{1,76} = 5.64$, $p<0.05$). The simple main effect analysis showed that the advantage of SPT memory style over OT memory style was much greater for non-athletes ($F_{1,76} = 46.35$, $p<0.001$) than for athletes ($F_{1,76} = 11.90$, $p<0.01$). Hence, we conclude that motor experience helps to enhance action memory, and action memory is better when actions are self-performed, especially for people with less motor experience.

Conceptions of adolescent friendship quality in sport and music domains

Phillips, Alison C., Weiss, Maureen R., University of Minnesota

The social context in which friendship interactions occur is important for understanding youths' developmental experiences (e.g., Weiss & Stuntz, 2004; Zarbatany, 1990). Sport and music are two of the most popular activities for youth, but little systematic research has been conducted to compare perceptions of friendships in these two domains. Based on interpersonal theory of psychiatry (Sullivan, 1953) and competence motivation theory (Harter, 1978), the purposes of the present study were to (a) compare conceptions of friendship quality in youth sport and music, and (b) examine the pattern of relationships among friendship quality, perceived competence, affect, and motivational orientation in sport and music. Adolescents (N = 366; Mage = 12.9, SD = 1.0) who were involved in both organized sport and music completed measures of domain-specific friendship quality, perceived competence, enjoyment, performance anxiety, and motivational orientation. For purpose one, a repeated measures MANOVA revealed that (a) boys and girls rated their best sport friends higher in self-esteem enhancement and supportiveness than their best music friends, (b) boys rated their best sport friends higher in loyalty and intimacy, things in common, companionship and pleasant play, and conflict resolution than their best music friends, and (c) there were no domain differences in friendship conflict. For purpose two, structural equation modeling revealed that (a) for sport, positive friendship quality was directly associated with perceived competence and indirectly associated with enjoyment, performance anxiety, and motivational orientation, and (b) for music, positive friendship quality was related to motivational beliefs in similar ways as sport, but friendship conflict was also related to competence motivation variables. Collectively, findings provide support for Sullivan's (1953) interpersonal theory of psychiatry and Harter's (1978) competence motivation theory and demonstrate the significance of friendship quality for adolescents involved in sport and music.—*NASPSPA Student Research Grant; University of Minnesota GradSEHD Research Grant*

The effects of acute physical activity intensity and BDNF val66met genotype on memory performance

Piepmeier, Aaron T., University of North Carolina Chapel Hill; Etnier, Jennifer L., University of North Carolina Greensboro

There is strong evidence supporting a beneficial effect of acute physical activity (PA) on cognition (Chang, Labban, Gapin, & Etnier, 2012; Lambourne & Tomporowski, 2010; Roig, Nordbrandt, Geertsen, & Nielsen, 2013). Additionally, factors such as PA intensity and cognitive domain have been shown to moderate this effect (Chang et al., 2012; Lambourne & Tomporowski, 2010). However, to gain a more complete understanding of the acute PA-

cognition relationship the role of potential biological moderators, such as genetic variation must be explored. This is a step towards developing personalized PA prescriptions to benefit memory. Differences in memory performance have been shown to be related to a specific variation in the brain-derived neurotrophic factor gene (BDNF; val66met genotype) (Egan et al., 2003; Hariri et al., 2003). However, the val66met BDNF genotype has yet to be tested within the acute PA-cognition relationship. Hence, this study used a randomized control design to explore the effect of BDNF genotype and acute PA intensity on memory performance. The findings showed that light intensity acute PA resulted in significantly better short-term memory performance compared to vigorous intensity or control (non-PA) conditions, with no significant effect from BDNF genotype. Long-term memory performance (24hr) significantly differed as a function of BDNF genotype, with those homozygous for the val allele (i.e., val/val) having significantly better memory performance than those heterozygous for the val allele (i.e., val/met). Findings suggest that the effect of acute PA on short-term memory may be dependent on the intensity of the PA, but not on BDNF genotype. Additionally, the BDNF met allele may hinder the retention of long-term memory regardless of prior acute PA participation. Future studies would advance knowledge of the acute PA-BDNF val66met-memory relationship by exploring additional memory sub-types (e.g., auditory, visual, spatial), and by considering effects of gene-gene interactions as well as the expression of their encoded proteins.—*NASPSPA, ACSM*

Former youth athletes' perceptions and experiences of life skills transfer from an intensive sport camp

Pierce, Scott, Illinois State University; Gould, Daniel; Erickson, Karl; Smith, Alan; Hellmann, Elizabeth; Michigan State University

There is a growing body of evidence that sport can develop beneficial skills and behaviors for young people to use in multiple life domains (Gould & Westfall, 2013). Some researchers (e.g., Coakley, 2011), however, have questioned whether life skills are actually learned in sport and, if learned, whether they transfer to other life contexts. While recent efforts have been made to understand the process of life skills transfer (e.g., Turnnidge, Cote & Hancock, 2014), researchers need to do more to understand if, how and why it occurs (Camir", 2014). The purpose of this study was to examine if, how and why former athletes of an intensive wrestling camp believe life skills were developed and are transferred to life domains outside of the camp. A phenomenographic research approach was used to interview 12 former campers who had voluntarily reported, through a letter to the camp director, that the camp had a positive impact on their lives. The study found that former campers learned and developed knowledge, behaviors, skills and dispositions from the camp. Over time, participants then transferred these assets to other life domains, collectively, as a personal guiding identity for success. This identity was defined by a strong work ethic and a deep belief in one's ability to use that work ethic to overcome any task or experience in life. Individual developmental variations will be presented, showing that camper's formed a personal narrative lens that expressed their motivational orientation, guided their reflection and discussion of sport and life experiences, and fueled their quest for success in life after the camp. These findings will be discussed in connection to identity development through sport, explicit and implicit approaches to understanding life skills transfer from sport (Turnnidge et al., 2014), and the need to understand life skills as a complex, individualized process. Implications for future research and practice in life skills transfer will be provided.

'Weighing in' on body image emotions and depression: Implications for breast cancer survivors in the first year post-treatment

Pila, Eva, University of Toronto; Castonguay, Andree L., Concordia University; Sabiston, Catherine M., University of Toronto

For breast cancer survivors (BCS), weight gain is a common post- treatment concern and is a well-documented risk factor for cancer reoccurrence and cancer-related mortality. Although physical activity is commonly recommended as a strategy for addressing weight gain, BCS report body image and mental health concerns as barriers to weight management. The effects of weight changes on women's body- related and mental health concerns need to be further elucidated before physical activity recommendations for weight management can be made. This study examined the role of weight changes on body-related guilt, shame and depression outcomes among women in the first year post-treatment for breast cancer. Objective body weight and self- reported body-related shame, body-related guilt, depressive symptoms, and pre-cancer body weight cycling were assessed in a longitudinal sample of 173 female BCS (Mage= 55.01"10.96 years). Findings from hierarchical linear models showed that BCS had

increased levels of body-related shame (β = 0.03), but not guilt (β = 0.01) or depressive symptoms (β = -0.01) if they experienced higher (as compared to lower) levels of objective body weight than their average in the first year post-treatment. Additionally, objective body weight was associated with higher levels of body-related shame (β = 0.23, SE = 0.06, t(16) = 3.68), guilt (β = 0.26, SE = 0.06, t(16) = 4.25), and depressive symptoms (β = 0.15, SE = 0.03, t(16) = 4.63), particularly among participants who have a history of pre-cancer weight cycling, compared to those who have a stable pre-cancer weight. These findings support the importance of women's pre-cancer weight history and post-cancer weight trajectory in impacting body image and mental health outcomes during survivorship. Women with a lifetime history of weight concerns are at highest risk for mental health consequences and face significant challenges in adopting health behaviors, such as physical activity.

Social-cognitive predictors of physical therapy outcomes among patients with chronic low back pain
Podlog, Les, Fritz, Julie, Hall, Morgan S., University of Utah

For patients with chronic low back pain (CLBP), treatment adherence is essential for achieving optimal outcomes, specifically, pain reduction and improved function. Unfortunately, treatment adherence is a recognized problem with this patient population. Research has shown that patient motivation for attending rehabilitation and patient efficacy levels have important implications for treatment adherence and clinical outcomes (Brennan et al., 2006; Kolt & McEvoy, 2003), yet this research has not extended to outpatient physical therapy and patients with CLBP. To close gaps that exist in optimizing treatment of CLBP, we sought to examine: 1) motivations of CLBP to attend physical therapy, 2) self-efficacy perceptions to successfully complete rehabilitation exercises and 3) associations between motivations for PT, self-efficacy, and patient-centered outcomes. A greater understanding of motivation and self-efficacy perceptions in patients with CLBP who are scheduled to commence physical therapy can lead to theory-based interventions aimed at enhancing adherence and clinical outcomes. Following IRB approval, 49 male (n=14) and female (n= 35) participants between the ages of 19 and 82 (M= 45.61 SD= 17.56) completed measures of self-efficacy, motivation regulation, and pain/disability levels prior to starting PT and 6 weeks following the initial PT appointment. The majority of patients indicated that they had suffered from back problems for more than 6 months. Linear regression analyses revealed that pre-physical therapy self-efficacy predicted post PT pain (B=-.63, t= -3.68, p<.001, R2= .31) and disability (B= -.164, t= -2.907, p=.007, R2= .23). Further, autonomous motivation pre-PT also predicted patient disability following PT (B= -4.028, t=-2.226, p=.035, R2= .196). Controlled motivation did not significantly predict either pain or patient disability. These results indicate that as patients' perceptions of self-efficacy and autonomous motivation increase, perceptions of pain and disability decrease.

Relationships between hope and training hours among adolescent Swedish soccer players
Podlog, Les William., University of Utah; Gustafsson, Henrik, Wagnsson, Stefan, Lundqvist, Carolina, Karlstad University; Johansson, Mattias, Örebro University

Research has shown the benefits of hope in various life domains (Edwards & McClintok, 2013). Scant empirical attention however, has been given to the potential outcomes of hope in a sport context. One essential outcome of direct relevance to sport performance is the amount of time spent training (Williams, 2008). The purpose of the present study therefore was to: 1) investigate relationships between hope and the amount of time spent in training, and 2) examine potential differences in hope between athletes of various competitive levels. Participants were 238 Swedish soccer players (166 males, 71 females; one did not indicate gender) aged 15-19 years who completed demographic information regarding level of competition, number of hours in training per week, and trait hope. Correlation analysis indicated that hope was positively associated with increased training hours (r = .32, p < .01). Furthermore, linear regression analysis revealed that trait hope accounted for 10% variability (adjusted r2 = .96, p < .0001) in the number of training hours per week. One-way ANOVA also revealed a statistically significant difference in hope scores for the four competitive levels [F(3, 290)= 3, p = .02] with an eta squared effect size of .05. Post hoc analysis using Tukey HSD revealed that international caliber athletes had significantly higher hope (mean = 6.46, SD = .86) than their national (mean = 5.77, SD = .99), regional (mean = 5.45, SD = 1.32), or local (mean = 5.7, SD = .92) counterparts. The present findings indicate that hope may be beneficial in the promotion of training, a key ingredient in successful athletic performance. That hope was positively associated with increased training time suggests that high-hope athletes' may be more inclined to put in time, energy, and effort towards their goals because they believe that doing so will result in goal attainment.

Passion and the feeling of having time to act in sport: The mediating role of mindfulness and perceived competence

Porlier, Genevieve, University de Montreal; St-Louis, Ariane, Vallerand, Robert J., University du Quebec Montreal

Some players manage to offer a last-minute winner to their team. For instance, Joe Montana led his team to victory with 34 seconds remaining to the game during the XXIII Super Bowl. The same scenario was repeated in 1998 NBA finals when Michael Jordan scored with only 5.6 seconds left to the game. The present study investigated the psychological factors that encourage athletes to feel like they have time to act during crucial moments of a game. The Dualistic Model of Passion (DMP; Vallerand et al., 2003; Vallerand, 2015) posits that harmonious passion provides access to self-adaptive processes, such as mindfulness and competence, which, in turn, lead to the feeling of having time to act. A sample of 500 sportsmen was recruited to validate these hypotheses. Participants completed an online questionnaire measuring passion in sport (Marsh et al., 2013), mindfulness (Feldman et al., 2007), perceived competence (Ng, Lonsdale & Hodge, 2011), and the feeling of having time to act (Vallerand & Porlier, 2015). Results from a path analysis showed that harmonious passion positively predicted mindfulness and perceived competence, which, in turn, positively predicted the feeling of having time to act. Conversely, obsessive passion negatively predicted mindfulness and the feeling of having time to act. Overall, these results support the DMP and pave way for future studies on the construct of time in sports.

Trust in sport and exercise apps' effects on exercise behavior

Querfurth, Sydney C., Schuecker, Linda, University of Muenster

New apps and technologies developed due to the growing popularity of big data and self-quantification make it easier to accurately assess and quantify trainings and workouts (Swan, 2013). Research has shown that trust in technology is an important predictor of continued use and deeper exploration of the technology (Janson, Hoffmann, Hoffmann, & Leimeister, 2013). Trust in training and fitness apps could increase the use of these apps and thereby help people adopt and maintain an active lifestyle. In the present study a scale of trust in technology (McKnight, Carter, Thatcher, & Clay, 2011) was adapted to the context of exercise apps and the relationship between trust in an app and exercise behavior was examined. The measure encompasses 29 items on eight subscales, measuring antecedents of trustworthiness, factors of general trusting behaviors and overall trust in technology. In an online survey N = 84 participants currently using an exercise app on a regular basis filled out a questionnaire on trust in technology as well as on general exercise behavior. Participants indicated, that they used an app either for running (n = 40, 47,6%) for general fitness workouts (n = 38, 45,2%) or other activities (e.g. cycling; n = 6, 7,2%). Overall the reliability for the subscales of the questionnaire was good (Cronach's alpha ranging from alpha = .74 to alpha = .87). There was no difference in the trustworthiness of running apps (m = 5.4, sd = 0.88, on a Likert Scale from 1 to 7) or fitness apps (m = 5.1, sd = 0.98; t(76) = 1.73, p = .09). In this sample, higher levels of general trust in an exercise app correlated with a higher number of workouts per week (r = .28 p < .05). The results indicate a relationship between trust in exercise apps and exercise behaviors. Future research should take a closer look at how apps could positively influence exercise behaviors, which role trust plays and how trust in the app can be fostered. *Research conducted as part of the research training group "Trust and Communication in a Digitized World" funded by the DFG (Deutsche Forschungsgemeinschaft, German Research Foundation)*

A qualitative exploration of the positive experiences and life skills developed through participation in university sport.

Rathwell, Scott, Young, Bradley W., University of Ottawa

Governing bodies of university sport have recently announced more holistic approaches to athlete development, focusing more attention on their athletes' academic success and personal and socio-emotional growth (CIS, 2013; NCAA, 2015). Although there is a wealth of studies on younger sporting cohorts (Gould & Carson, 2008), a lack of empirical information still exists on a) whether personal and socio-emotional competencies are developed within university sport settings, and b) which of these competencies influence student athletes' success in academia and in life. The aim of the current study was to qualitatively examine the positive development experiences of university athletes and the life skills they developed through their participation in Canadian university sport programs. Semi-structured open-ended interviews were conducted with 15 student-athletes (5 male, 10 female; Mage = 22, range =

17-26, SD = 2.71), from 12 universities. A directed content analysis guided by positive development themes found within the YES 2.0 (Hansen & Larson, 2005) was used to identify, analyze, report, and discuss categories within the data (Hsieh & Shannon, 2005). Athletes discussed developmental experiences and life skills related to a) identity, b) initiative, c) emotions, d) cognitive skills, e) adult network and social capital, f) positive relationships, g) teamwork and social skills and f) negative experiences. Discussion focuses on which life skills are most pertinent for university aged athletes, as well as the application of life skills in and outside of sport. We further discuss the implications that athletes' elaboration of life skill themes have in regards to the YES 2.0, suggesting that themes captured in such quantitative tools are not exhaustive.

The exploration and validation of a personal and socio-emotional development scale for university sport.
Rathwell, Scott, Young, Bradley W., University of Ottawa

Much of the work on positive development through sport focuses on youth sport participation, while few have examined university sport. Further, no specific assessment tool for personal and socio-emotional development resulting from university sport exists. Therefore, the purpose of this multi-study project was to validate a preliminary tool using two independent samples of Canadian university athletes. In Study one, 605 athletes from 39 universities completed 99 items drawn from a survey widely used in youth sport - the YES 2.0, including re-integrated YES 1.0 items (Hansen & Larson, 2002, 2005). Separate measurement models were considered for all 99 items, 70 items for the YES 2.0, and a 37 item nested model representing the YES-Sport version for youth (MacDonald et al., 2012). We conducted confirmatory factor analyses (CFA) on all models to determine initial fit, as well as exploratory analyses for re-specification purposes. CFAs indicated fit issues with previous models. Exploratory analyses improved fit and resulted in a 20 item, 6-factor model assessing four positive outcomes (athlete leadership, goal setting, cognitive skills, off campus community) and two negative experiences (stress, negative leadership). In Study two, 511 athletes completed the same 99 items. CFAs were conducted to test fit. The resultant model determined in Study one was a) confirmed, CFI = .959, RMSEA = .048, SRMR = .055, and b) showed superior fit indices compared to all prior youth models. The resultant instrument, entitled Perceived Development Survey for University Sport (PDS-US), provides a reliable instrument for measuring development in university sport. Results help identify the items that can be borrowed from previous instruments in youth sport for use in the university setting. The PDS-US reveals how these items can be arranged in a conceptually sound fashion, with scales demonstrating strong factorial validity, convergent validity, and discriminant validity, which is an important first step towards validating a more expansive positive development scale for university sport.—*SSHRC*

The influence of visual strategies used by National Water Polo goalies on decision time and accuracy improvement through a video based perceptual training program.
Richard, Veronique, University de Montreal; Fournier, Jean, Institut Nationale du Sport du Quebec; Lasnier, Jonathan, University de Montreal

It has been shown that video-based perceptual training improves cognitive and perceptual skills resulting in decreased decision time and increased decision accuracy in both simulation and field settings. It has also been shown that visual strategies employed by athletes influence decision-making in similar field settings. Thus, the goal of the present study was to implement a 14-week video-based perceptual training program to help 3 Canadian national team water polo goalies improve their decision making time and accuracy while tracking their visual strategies. Results show a decrease of 0,23 seconds in reaction time for one athlete; visual strategies used by this athlete, characterized by longer fixation on few fixed points, could partly explain this improvement. Finally, decision-making accuracy improved by an average of 15% in real game situations. In addition to visual strategies, the current results highlight the need to consider a number of things for the implementation of a video-based perceptual training, such as video structure and perspective, athlete engagement and general coaching approach. This study will therefore help coaches and practitioners better understand how to lead an efficient video-based perceptual training program.

The effect of preferred physical positioning on perceived effort and performance during group exercise
Richards, Devyn, Bruner, Brenda, Arnocky, Steven, Bruner, Mark W., Nipissing University

Empirical evidence suggests physical position in a group setting (e.g., a classroom) can influence performance (Akimoto et al., 2000). However, it is unknown if preferred physical positioning in a group exercise setting would also influence performance. The purpose of this study was to examine the influence of changes in physical positioning on perceived effort and performance during exercise. Twenty-seven fitness club members (Mage = 39.8 years) who regularly attended group cycling classes were recruited for a four week intervention. During the first two weeks of the intervention (baseline), participants chose and remained in their preferred position in the exercise class. Participants were then randomly assigned to either an experimental (assigned bike) or control (preferred bike) condition for one week. During the final week, participants again chose their preferred position. Participants completed baseline measures of obligatory exercise (Pasman & Thompson, 1988) and exercise history (e.g., number of exercise sessions per week). Heart rate and distance cycled were objectively assessed during all exercise classes as well as self-reported perceived effort (Bruner & Spink, 2011). A 2X3 RM ANOVA controlling for age, obligatory exercise score and number of cycling classes per week revealed a significant interaction in perceived effort $F(1, 22) = 6.04$, $p < .05$). The interaction revealed that participants in the manipulation group showed a decline in perceived effort when asked to switch position, but no significant change in objective measures of performance. The findings indicate that regardless of preferred physical position in a group exercise setting, exercise performance will remain consistent, even if perceived effort is decreased.

Relationship quality, engagement, hope, and self-worth in a physical activity-based positive youth development program
Riciputi, Shaina C., McDonough, Meghan H., Snyder, Frank J., Purdue University

Physical activity-based positive youth development (PYD) programs have the potential to promote positive psychosocial and personal growth in youth (Fraser-Thomas, C"t", & Deacon, 2005). Engagement, a motivationally-oriented construct characterized by both affective and behavioral qualities representing the subjective quality of youths' connection to a program (Skinner, Kindermann, Connell, & Wellborn, 2009), may be necessary for promoting the positive outcomes associated with PYD participation. Based on competence motivation theory (Harter, 2012), program staff may affect engagement by providing instructional feedback related to program activities and goals, and by fostering the interpersonal climate within the program. This study examined whether youths' perceptions of their relationship with their staff leader in a physical activity-based PYD program predicted changes in hope and global self-worth throughout the four-week program, and the degree to which these associations were mediated by behavioral and emotional engagement. Structural equation modeling results demonstrated that youth-staff relationship quality positively predicted changes in both emotional ($\beta = .41$, $p < .001$) and behavioral ($\beta = .29$, $p < .01$) engagement, but negatively predicted changes in hope ($\beta = -.24$, $p < .05$). Emotional, but not behavioral, engagement positively predicted changes in both global self-worth ($\beta = .28$, $p < .01$) and hope ($\beta = .46$, $p < .001$). There were no indirect effects of youth-staff relationship quality on either hope or global self-worth. Results suggest that promoting emotional engagement in PYD programs may be important for enhancing psychological outcomes among youth. Meanwhile, high quality youth-staff relationships may promote program engagement, stressing the importance of teaching staff how to develop positive relationships with youth in physical activity-based PYD programs.—*United States Department of Agriculture, National Institute of Food and Agriculture: Children, Youth, and Families at Risk*

Situation criticality's effect on basketball officials stress levels

Ritchie, Jason, Florida State University; Basevitch, Itay, Anglia Ruskin University; Rodenberg, Ryan, Tenenbaum, Gershon, Florida State University

Sport officials and referees are viewed as important game's agents which influence the process and outcome of the competition. They are expected to perform impeccably despite the wide range of stressors they experience. One such stressor is situation criticality where performance pressure increases due to crucial moments occurring during the game. Situation criticality is comprised of score differential (i.e., more pressure in close games) and time to play (i.e., more pressure as time expires). Surprisingly the link between situation criticality and officials' stress level has not been examined. Although support for a situation criticality-stress link was found in players (Bar-Eli & Tenenbaum, 1998). Thus, the aim of this study was to examine the game criticality-stress link in high school basketball officials through a survey methodology which consisted of game situations that varied in criticality level (i.e., score difference and time in game). For each of nine game situations (i.e., time - first two minutes, last two minutes in first half, and last two minutes in second half X score - tie game, one team leading by 3, one team leading by 9) officials completed the overall stress level and appraisal portions of the Stress Appraisal Measure (SAM; Peacock & Wong, 1990). Results revealed that situation criticality effects the officials' perceived stress level with stress level increasing as score difference and time remaining decreased. Both threat and challenge appraisals were positively correlated with perceived stress. Furthermore, officials' stress levels fluctuated within games as a function of score differential and time remaining to play with stress level increasing as score difference and time remaining decreased. The findings support the notion that officials and referees must manage stress appraisal across critical game situations to enable efficient perceptual-cognitive processes, such as situational awareness, information procession, and decision making in crucial parts of the competitive setting.

Perspectives on effective coaching from athletes and coaches

Robbins, Jamie, Methodist University; Killoran, Jessica, West Chester University; Polders, Daan, Villa Maria High School

Coaches' behaviors are said to impact athlete performance, behavior and satisfaction with their sport experience (Horn, 2002). However, behaviors may be perceived differently by different people; as such, coaches with the best of intentions may be unintentionally harming their athletes. The current study aimed to uncover any similarities or differences between coaches' and athletes' perceptions of harmful and helpful coaching behaviors using the Critical Incident Technique. This qualitative approach requires respondents to provide an explanation of the recalled incident in detail, thus proving the importance of the experience in their minds (Flanagan, 1954). Coaches (N=85) and athletes (N= 190) completed the questionnaires, and responses were analyzed independently and later together until consensus was achieved by the primary investigators (C"t", Salmela, Baria, & Russell, 1993). Reliability checks were initiated by a third reviewer who was provided a random sample of meaning units and asked to match them to the appropriate code, yielding above a 90% agreement (Miles & Huberman, 1994). Results revealed similarities and differences regarding harmful and helpful coaching behaviors between athletes and coaches, and among athletes. Emergent themes related to: attitude or behavior change, challenge, sport specific communication, off-field lack of support, mental training, physical preparation etc... A large discrepancy was evident in the overall number of harmful incidents recalled with 94% of athletes and only 48% of coaches providing examples. Less of a distinction was found in recalled helpful incidents, as 89% of coaches and 98% of athletes remembered those behaviors. Notably, several of the same behaviors were mentioned as helpful and harmful by different athletes. Further discussion will identify and explain specific themes, and suggestions for minimizing discrepancies in future coach-athlete interactions will be provided.

A systematic review of 25 years of research in talent selection: Preliminary results

Robinson, Kathryn, York University; Wattie, Nick, University of Ontario Institute of Technology; Schorer, J., University of Oldenburg; Baker, Joseph, York University

The assumption that there are early indicators of future potential is strongly engrained in many athlete development programs. This systematic review focused on developing a 'state of the science" understanding of the variables associated with talent selection decisions in sport. Articles were included if they described quantitative studies

written in English between the years of 1990 and 2015. Further, they had to involve a) skilled participants b) time-based analysis and c) between group comparisons. Searches were conducting according to the PRISMA guidelines using Web of Science and Sport Discus as well as "gray searching" of previous works. Preliminary results identified 19 studies, organized into four categories that reflected the focus of their comparisons. These categories were pre-experience variables (2 studies), physical/anthropometric predictors (12 studies), psychological predictors (2 studies), and mixed outcomes (3 studies). There was a clear emphasis on physical/anthropometric variables with very few studies examining psychological or perceptual-cognitive factors. Thirteen sports were represented in the review (one study included 4 sports), although the majority of work was focused in soccer (n=6), rugby league (n=3), gymnastics (n=3) and handball (n=2). The other sports were represented by singular studies. There was also an emphasis on male samples. In general, results highlight the scarcity of research in this area and the clear need for additional work, particularly using multi-disciplinary approaches instead of focusing on physical qualities. This conclusion is particularly salient given the consequences of talent selection decisions on athlete outcomes. This review provides insight regarding the limits of current knowledge and indicates several areas for future work.

Assessing need-supportive and need-thwarting interpersonal behaviors in sport: The Interpersonal Behaviors Questionnaire (IBQ)

Rocchi, Meredith, Pelletier, Luc, Cheung, Susanna, Desmarais, Philippe, Beaudry, Simon, Baxter, Daniel, University of Ottawa

The objectives of the present studies were to design and validate the Interpersonal Behaviors Questionnaire (IBQ). The IBQ assesses perceptions of the extent other people in the sport environment engage in need-supportive or need-thwarting interpersonal behaviors according to Basic Needs Theory, under the Self-Determination Theory framework (i.e., autonomy, competence, and relatedness). The measure can also be completed on behalf of athletes or coaches to report the extent to which they engage in these behaviors with others in sport. The measure was validated through a series of 4 studies. In Study 1, undergraduate students were asked to report on the behaviors of people in their lives, using a general stem. Through a series of confirmatory factor and item response theory (IRT) analyses, a six-factor, 24-item scale structure was determined. Results supported the validity of the scale and correlation analyses suggested that the IBQ subscales were related to basic need satisfaction. In Study 2, the psychometric properties of the scale were re-evaluated with a sample of athletes using the stem "my coach" and the scale was tested for gender invariance. Results suggested that the scale structure held and that it was invariant across athletes' genders. In Study 3, the scale was re-tested using another sample of athletes using 3 stems to validate that its structure held within specific relationships in the sport environment (i.e., coach, teammates, and parents). Psychometric properties and invariance tests were conducted to evaluate the scale in all three social contexts and the results supported the scale structure. Finally, in Study 4, a sample of coaches completed the scale about the extent to which they engaged in the behaviors in their interactions with their athletes. Again, the results supported the structure of the scale in this sample. Overall, the results of all four studies supported the validity of the IBQ as a measure of need-supportive and need-thwarting interpersonal behaviors in sport, under the Self-Determination Theory framework.—*Social Sciences and Humanities Research Council*

Pain coping and anxiety in ballet dancers

Ross, Emily, Reed, Aneliis, Avans, Diana, Vanguard University

The purpose of this study was to determine the levels of hardiness, anxiety, and coping strategies used by pre-professional ballet dancers. The participants were 31 ballet students (n=3 males, n=28 females) ages 17-24 (M=19.9, SD=2.09). Participants had M = 14.6 years of experience. The Sport Anxiety Scale (SAS-2) and the Coping Strategies Inventory (CSI) were modified to reflect ballet specific scenarios/terminology. The CSI contains 8 sub-scales including problem solving, cognitive restructuring, social support, emotional expression, and problem avoidance. These are then grouped into 4 sub-sets: Problem Focused Engagement/Disengagement (PFE/PFD) and Emotion Focused Engagement/Disengagement (EFE/EFD). The strategy used most often was PFE followed by PFD, EFE and EFD. Pearson Correlation determined the relationship between coping methods, both individual and grouped, and the 3 scales of the SAS-2. There were several significant relationships ranging from moderate to high strength. All four groupings were significantly correlated with the SAS-2 subscales; somatic anxiety, worry, and cognitive disruption. The only non-significant correlations were with PFD, EFD and Worry. Using the individual

scales, Problem Solving, Cognitive Restructuring, Wishful Thinking and Social Support were the four most common strategies and were significantly correlated with Somatic anxiety, worry, and cognitive disruption. The strongest were Cognitive restructuring with somatic anxiety (r = 0.832) and social support with somatic anxiety (r = 0.794). The strongest grouped correlation was somatic anxiety with problem focused engagement strategies (r=0.763). This study highlighted an area not commonly explored dancers by including the relationship with anxiety. Hardiness was not directly measured; therefore further research is needed to determine the relationship of hardiness pain coping. Further study could seek to understand if various pain inducing scenarios changed the coping strategy such as pain in pointe shoes, the presence of common dance injuries or performance levels.

The effect of a weight management clinic on body perception

Ross-Stewart, Lindsay C., Anderson, Marissa, Stumpf, Jamie, Knuth, Alexa, Brent, Corinne, Smith, Bryan, Southern Illinois University Edwardsville

While body image disturbances continue to be seen in individuals living in the Western society, research has shown that both weight loss and exercise participation can decrease body image disturbance in both men and women. The purpose of the study was to examine the effect of a weight management clinic on body perception of obese individuals. Thirty nine participants were a part of a three-month weight management program with caloric restrictive diets and weekly exercise recommendations. The 34-item Multidimensional Body Self Relation Questionnaire, Body Assessment Scale and Social Physique Anxiety Questionnaire were administered at baseline and 12 weeks. All physiological measurements were conducted at baseline and 12 weeks. Based on participant's weight loss, they were divided into two groups: weight loss and no weight loss. A 2 (baseline, 12 week) X 2 (weight loss achieved, weight loss not achieved) repeated measures ANOVA was conducted with difference between ideal and current body position as the dependent variable to examine the relationship between weight loss and body perception. A 2 (baseline, 12 week) X 2 (weight loss achieved, weight loss not achieved) repeated measures ANOVA with social physique anxiety as the dependent variable was conducted to examine the relationship between weight loss goal achieved and body perception. A 2 (baseline, 12 week) X 2 (weight loss achieved, weight loss not achieved) repeated measures ANOVA with the MBRSQ-AS subscales as the dependent variable was conducted to examine the relationship between weight loss goal achieved and body perception. A Pearson correlation was run to predict weight loss from the MBSRQ-AS subscales, SPA and BAS. The results of this study indicate that there was a significant difference in body perception from baseline to 12 weeks, regardless of weight loss achieved by participants. Additionally, there was no correlation between weight loss and body perception variables.

A qualitative examination of physical activity perceptions in the no boundaries running program

Rothberger, Sara M., The University of North Carolina at Greensboro

Many physical activity programs evaluate effectiveness through the use of physiological and survey measures, but few assessments include participants' perceptions. The aim of this study was to examine changes in self-perceptions of individuals participating in a 12-week beginning running program, the No Boundaries program. Over the course of the 12-week program, three methods of data collection took place. First, observations were completed with the researcher as both a non-participant and participant observer. Second, online individual interviews were conducted with 18 adults (15 females, three males), ranging from 29 to 70 years of age (M = 50.2 years, SD = 12.2 years). Finally, focus group interviews were took place with an additional eight female participants aged 18-32 years (M = 24 years, SD = 7.6 years). In both individual and focus group semi-structured interviews, participants were asked to describe their experiences in the No Boundaries program. Specific question topics asked participants to identify important aspects of the program, individual goals for the duration of the program, how the program impacted the lives of participants, and areas for program improvement. Interview transcripts were transcribed, coded, and analyzed to produce themes. Two major categories emerged from the data - social support and goal-striving. Social support included experiencing a sense of belonging and encouragement from peers and coaches. Goal-striving included setting and achieving goals, which were related to participant self- confidence. The results indicated that social support, goal setting, and self-confidence are important factors in helping beginners adhere to an exercise program. The No Boundaries program had a positive impact on participants' self-confidence, which has implications for physical activity and exercise adherence. Overall, these findings have important implications for the efforts to

increase running related self-efficacy, to foster positive self-perceptions, and increase exercise program adherence and long-term physical activity participation.

Alcohol and ice hockey: Documenting binge drinking-related activities during a junior-level tournament
Roy, Jonathan, Camiré, Martin, University of Ottawa

Research has shown how sport participants have higher rates of alcohol consumption than nonparticipants (Kwan et al., 2014). Ice hockey has been identified as a sport where athletes are particularly involved in binge drinking (Ford, 2007). However, actual episodes of binge drinking have rarely been documented in the literature to understand the events surrounding ice hockey that influence excessive consumption. The purpose of this study was to follow a junior ice hockey team (Junior A) from Quebec during a 4-day tournament and document their activities. The researcher was granted full access to all team activities during the tournament, which were extensively documented through 10 single-spaced pages of field notes. Further, semi-structured interviews were conducted one week following the tournament with 2 coaches and 3 players between 19-24 years of age (M = 21.6). Results showed how the tournament was perceived as a special event during the ice hockey season and activities were intentionally planned during the 4-day period to have binge drinking as an integral part of the experience. Both coaches and players discussed how alcohol-related activities (e.g., going out to the bars, interacting with females) took precedence, with actual hockey activities coming second. While under the influence of alcohol, team members engaged in a wide range of risky activities, such as driving, one-night stands, and vandalism in their hotel rooms. Findings provide vivid insights into the subculture of alcohol consumption in recreational junior ice hockey and associated risk factors.—*Social Sciences and Humanities Research Council of Canada*

An examination of positive self-review and feed-forward self-modeling on dominant and non-dominant hand free-throw shot self-efficacy
Rymal, Amanda M., California State University, San Bernardino; O, Jenny, California State University, East Bay; Miller, Cody, Leighton, Sarah, California State University, San Bernardino

Regarding observation, a research gap recently identified by Ste-Marie and colleagues (2012) is related to who is being observed. Research has shown that viewing oneself is more beneficial than viewing another, relative to enhancing performance and self-efficacy (SE; for a review, see McCullagh et al., 2012). However, a question that remains is whether feed-forward self-modeling (FF; i.e., viewing oneself perform at levels not yet achieved using edited video) elicits differential effects than positive self-review (PSR; i.e., viewing oneself at current performance levels). Mirror reversal is a form of FF self-modeling wherein video footage is digitally "flipped" to simulate performance on the contralateral side of actual performance. This flipped video is then viewed by the learner in an attempt to enhance contralateral side skill learning (e.g., Anderson & Keaney, 2015; Steel et al., 2013). To our knowledge, researchers have not investigated the effects of FF and PSR on task SE. The current research examined the effects of PSR and FF self-modeling (mirror reversal) on individuals' basketball free throw SE for non-dominant and dominant hands. Participants (N=87) were divided into four experimental groups (based on type of self-model viewed): PSR Dominant, PSR Non-dominant, FF Dominant, and FF Non-dominant. During each of four separate sessions, participants completed 10 free throw shots with each hand. FF/PSR videos were viewed during sessions two and three (i.e., intervention phase). SE measures were administered at baseline, intervention, and retention phases. Results of two separate factorial MANOVAs ($\alpha = 0.25$) indicated that type of video did not differentially contribute to changes in SE for either hand (no significant interaction effects were observed). These results suggest that despite technological advances enabling construction of more complex self-modeling videos (i.e., FF and/or mirror reversal) such videos may not be a time-efficient nor necessary option for enhancing one's SE for certain motor skills.

Can emotional disclosure promote stress-related growth following sport injury?
Salim, Jade, Wadey, Ross, St. Mary's University, Twickenham

Previous research has shown injured athletes low in resilience are less likely to experience stress-related growth (SRG) than their more resilient counterparts (e.g., Salim, Wadey, & Diss, 2015; Wadey, Evans, Hanton, & Neil, 2012). This study aimed to examine the efficacy of a four-week emotional disclosure intervention to promote stress-

related growth (SRG) with injured athletes low in resilience following their return to competitive sport. The intervention consisted of three groups: Written Disclosure Group (WD) (N = 15), Verbal Disclosure Group (VD) (N = 15), and a Control Group (C) (N = 15). For the purposes of social validation, 10 athletes from each group (N=30) were interviewed three months after the intervention. Data was analyzed using a mixed-design (Group x Time) MANOVA, whereas the qualitative data was analyzed using thematic analysis. Findings revealed a significant difference between the VD Group and C Group for SRG. There was no significant difference between the WD Group and C Group. Both the VD and the WD Groups reported that they found writing or talking to be cathartic. However, while those in the VD Group were able to positively accommodate their thoughts and emotions that led to SRG, those in the WD Group reported that they were unable to fully understand their emotions. The organismic valuing theory (Joseph & Linley, 2005) and broaden and build theory (Fredrickson, 2001) are used to interpret these findings. These findings have important implications for injury clinics, sporting clubs, and organizations to promote desirable recovery outcomes following sport injury.

Cyber partners for long-term space missions: Boosting motivation to maintain intense exercise

Samendinger, Stephen, Ede, Alison, Hill, Christopher R., Winn, Brian, Pivarnik, James M., Kerr, Norbert L., Max, Emery J., Michigan State University; Ploutz-Snyder, Lori, Universities Space Research Association; Feltz, Deborah L., Michigan State University

High intensity exercise for astronauts is hypothesized to minimize long space mission losses in bone density, muscle mass, and cardiovascular function. However, astronauts may have difficulty maintaining vigorous exercise intensity levels during long missions. The purpose of this study was to use group dynamics principles (working together toward a shared goal with a slightly-faster partner) to improve the motivation of adults, similar in age and fitness to astronauts. Participants were asked to maintain high intensity exercise through the use of an exercise video game (exergame) and software-generated partner (SGP) over 24-weeks in a cycle ergometer protocol and were randomized to exercise in one of three conditions: no partner individual control (IC), with an always faster SGP (AFP), with an SGP who was not always faster (NAF). In partnered conditions, team score was dependent on the inferior member. Participants (N=22, 12 male; Mage=46.3 years) exercised 6 days/week for 24 weeks alternating between moderate- intensity continuous and high-intensity interval sessions. Participants were told they may increase cycle ergometer wattage to increase intensity and speed during the sessions. Mean change in cycle ergometer workload (Watts) from the initial interval session intensity (90% HR max) was the primary dependent variable reflecting motivational effort, as increasing workload at this intensity is challenging. Participants in both partnered conditions consistently exceeded IC participants in workload change per session and at 21 weeks (last week of complete data), AFP participants increased their workload more (M=8.32) compared to IC (M=2.15; d=0.77) and NAF participants (M=0.82; d=0.99). The mean increase in workload represents the AFP participants' motivation to work above their 90% HRmax intensity, where as participants in the other conditions did not significantly change the workload prescribed for them. Preliminary results suggest exercising with an always faster SGP, toward a team goal, is more motivating than exercising alone or with a not always faster SGP.—
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Physical activity, well-being and the basic psychological needs in cardiac rehabilitation graduates: A preliminary analysis

Saunders, Chelsey, Sweet, Shane N., McGill University

Both physical activity and well-being have been shown to protect against cardiovascular disease. However, the relationship between these variables is not well understood in individuals with cardiovascular disease. The purpose of this study was to preliminary examine the relationship between physical activity intensities, well-being and the basic psychological needs among cardiac rehabilitation graduates. Participants (N=29, Mean age=64 (SD =7.39); 75% male) answered the Godin Leisure Time Exercise Questionnaire to assess physical activity intensities. Well-being was measured by eudaimonic motives, hedonic motives, positive and negative affect, interest, life satisfaction, carefreeness, meaning and elevating experience. Participants also answered autonomy, relatedness and competence items to assess the basic psychological needs. Correlation analyses were conducted to examine the relationships. Moderate intensity physical activity had moderate to strong correlations with hedonic motives (r =.33, p =.09), life satisfaction (r =.31, p =.13), elevating experience (r =.47, p =.02), carefreeness (r =.36, p =.08), meaning (r=.37, p

=.07), interest (r =.42, p =.03), autonomy (r =.44, p =.03) and competence (r =.35, p =.08). Vigorous intensity physical activity only had a moderate negative correlation with meaning (r =-.29, p =.15), while light intensity physical activity was only moderately related with life satisfaction (r=.32, p =.11). No other significant relationships were found. These preliminary results suggest that among cardiac rehabilitation graduates moderate intensity physical activity had stronger relationships with well-being outcomes than other physical activity intensities. These results can enhance our understanding of the physical activity - well-being relationship and specifically the role of moderate intensity physical activity. Such findings could inform the development of future physical activity and well-being interventions.

Exploring the running room clinic for breast cancer survivors

Saunders, Stephanie, Brunet, Jennifer, Gifford, Wendy, University of Ottawa; Hamilton, Ryan, University of New Brunswick; Thomas, Roanne, Morrison, Tricia, University of Ottawa

Cancer survivorship is a period in the cancer continuum when survivors attempt to return to "normal" living. Support groups may offer counseling, information and education to help survivors through the process. For example, counselors, social workers, nurses or psychologists may offer educational or emotional support in groups. Some such groups are offered in the community and designed for specific audiences. The Running Room's 'survivorship Clinic" provides breast cancer survivors (BCS) an opportunity to receive emotional support by having women run with other BCS. It also provides educational support by offering 10 weekly workshops to assist BCS as they train for the 5km Canadian Breast Cancer Foundation "Run for the Cure." We explored the impact the Running Room's clinic had on participating BCS'. Eight BCS were interviewed 2/3 weeks' post-clinic. Interviews were audio-recorded, transcribed verbatim, and thematically analyzed. Three themes were identified as having a positive impact: (1) receiving practical advice and information, (2) physical gains from training, and (3) getting into the right mindset. However, a fourth theme of feeling integrated or isolated from the group was identified as having a negative impact. This demonstrates that both positive and negative social experiences resulted based on running performance since BCS with poorer performances felt isolated. Thus, whereas the clinic satisfied some BCS' need for relatedness, it suggests the social benefits of the clinic may hinge on whether BCS feel the group is similar to them in terms of running abilities. It may be important to match women with similar running abilities.

Gender differences in psycho-affective state following concussion in active athletes

Sauve, William, Moore, Robert D., Ellemberg, Dave, University de Montreal

Female athletes are thought to be at greater risks for concussions and to report more symptoms following a concussion than male athletes (Covassin, 2007). Moreover, concussion or mild traumatic brain injuries are known to cause alterations in psycho-affective state (Jorge, 2004). However, few studies evaluated gender differences in psycho-affective outcome following a concussion (Barnes, 1998). Accordingly, the current study sought to longitudinally compare the psycho-affective outcomes of concussion between men and women at two time points following injury. Thirty collegiate athletes (14 females, age = 20.79 " 1.37; 16 males, age = 20.93 "1.12) completed the Beck's Depression Inventory-II (BDI-II) and the Profile of Mood States (POMS) 7 and 30 days following a concussion. Analyses failed to reveal any significant group differences at either time point for the POMS subscales or the total mood disturbance. However, female athletes reported significantly higher scores on the BDI- II relative to males at 7 days (p=0.05). Analyses also revealed a significant effect of time for the BDI-II (p=0.004) as well as the anger (p=0.05), vigor (p=0.03), fatigue (p=0.01), confusion (p=0.01) subscales and the total mood disturbance (POMS; p=0.03). The current results suggest that gender differences in the psycho- affective outcomes of concussion are selective to depression in the acute phase of injury. These data also suggest that time since injury might be the most important factor moderating the intensity of psycho- affective symptoms of a concussion.—*CIHR*

The interaction of between year- and within year-effects in youth soccer

Schorer, J., Zander, Stephen, Steingrever, Christina, University of Oldenburg; Helsen, Werner, University of Leuven; Wattie, Nick, University of Ontario Institute of Technology; Baker, Joseph R., York University

Relative age effects (RAE) seem to be a rather robust phenomenon in sport (cf. Wattie, Schorer, & Baker, 2015). Surprisingly little research has focused on countries outside of Europe and North-America and no study has tried to

look at RAEs in the same sport around the globe. Therefore, the first aim of this study was to close this research gap by looking at data from the last five under-17 world cups in male soccer. A recent categorization of RAEs by Schorer and colleagues (2013) showed that there are interacting relative age effects that may also be relevant for understanding age effects in soccer, within-year effects and constant year effects. Therefore, the second aim of this study to check for interactions between these effects. For this study, players' birth dates, playing position, height and nationality were obtained via official FIFA websites for the male Under-17 soccer world championships from 2007 to 2015. For within year, birth dates were coded into four quartiles (within-year effects) and two-year categories (constant year effects). A global within-year effect was found, $\chi2(3) = 504.67$, $p < .01$. When differentiating between confederations, an expected within-year effect was found for all, $\chi2(3) = 22.96\text{-}221.57$, $p < .01$, with the exception of the sub-sahara region, $\chi2(3) = 38.18$, $p < .01$, where it was inversed. For the between year effect, even stronger effects were found, $\chi2(1) = 1306.98$, $p < .01$. Differentiating between world regions, all regions revealed an over-representation of the older year, $\chi2(1) = 28.80\text{-}512.81$, $p < .01$. For almost all regions an interaction was found with a pattern of a stronger within-year effect for the younger year group, although, again, this differed in the sub-sahara region. This study shows nicely that RAEs might not be as global as previously thought. The specific patterns in the sub-sahara region provides further insight into the nuances of RAEs, although further analyses are required. Results highlight the need to consider interactions between types of age effects.

The effect of aerobic fitness on variations of the flanker paradigm

Schott, Nadja, Diesch, Jessica, Klotzbier, Thomas, University of Stuttgart

Although cross-sectional studies generally support that aerobic fitness can confer a benefit for some of the executive functions, randomized controlled trials yield inconsistent results. The inconsistent results might be attributable to different variations of the cognitive task. The present study attempts to examine the effect of aerobic fitness on the stability of selective attention skills across context by varying the characteristics of task stimuli in a computerized flanker paradigm. We examined six computer versions of the flanker paradigm containing letters, chinese characters, arrows, shapes, worms, and fish in 73 adolescents (12 to 17-year olds, M = 14.03, SD = 0.94 years; 48 boys, 25 girls). Aerobic capacity was examined using the Progressive Aerobic Cardiovascular Endurance Run (PACER) subtest of the FitnessGram. Subjects responded faster on congruent trials (M = 633msec) than on incongruent trials (M = 664msec, indicating task-appropriate interference effects across five versions of the flanker paradigm (but not for shapes). In addition, there was a main effect for flanker version, with significantly faster responses noted in the arrows version (M = 562msec) than in the letters (M = 614msec), fish (M = 631msec), Chinese characters (M = 662msec), worms (M = 706msec) and shapes (M = 717msec) versions. High-fit children exhibited faster RTs for the congruent and incongruent conditions of the letter and Chinese character conditions compared to low-fit children. There was a significant main effect for variation (lowest accuracy rate for shapes, highest for arrows), congruency (higher accuracy rate for the congruent condition). Furthermore, there was a significant interaction between fitness and variation with high-fit children exhibiting higher accuracy rates for the shapes condition than low-fit children. In order to determine the most appropriate experimental designs with which to examine the effect of exercise on cognitive changes in adolescents, we need to more accurately understand the impact that variations in stimuli have on performance.

Attentional focusing in running: Indirect focus manipulations reflect the effects for direct verbal instructions

Schuecker, Linda, Hill, Antje, Babel, Shakti, University of Muenster; Hagemann, Norbert, University of Kassel

Numerous studies exhibit a detrimental effect of an internal focus of attention compared to an external focus of attention on running performance. So far these studies predominantly used direct verbal focus instructions in laboratory settings. The question is whether these instructed foci are comparable to conditions when participants voluntarily (or indirectly) adopt different attentional foci without the metal demand of adhering to a prescribed instruction. This study addresses the comparison of direct and indirect external and internal focus manipulations on running economy. This is based on the assumption that adopting a certain focus, either due to a direct verbal instruction (top-down) or an indirect non-verbal manipulation (bottom-up), are different ways of stimulus processing and might therefore lead to different focus effects. Forty trained runners were asked to complete a 36-min-submaximum run during which a focus on running movement (internal) and on a video (external) were implemented. Both foci were manipulated in a direct way being explicitly requested to do so, and in an indirect way

by creating situations where participants adopted the wanted focus while not being aware of it (i.e. video-taping the movement or a video simply appearing on the screen). The duration of each condition was three min, with 5-min intervals in between where participants ran without any instruction. To determine running economy, oxygen consumption (VO2) was assessed by spiroergometry. Repeated-measures ANOVA revealed a significant main effect for the focus condition, $F(1,39)=7.39$, $p=.010$, $\eta 2=.159$, with lower VO2 values in the external focus conditions ($M=31.66$, $SD=.75$) compared to the internal focus conditions ($M=32.10$, $SD=.73$). There was no main effect for the instruction type, $F(1,39)=1.49$, $p=.229$, and no significant interaction between type of instruction x attentional focus, $F(1,39)=.09$, $p=.926$. This finding strengthens the positive effect of adopting an external focus and adds to this research area by generalising the effects for different types of instruction.

Physical activity and well-being in 8-9 year old children from social disadvantage: testing a self-determination theory model

Shannon, Stephen, Brennan, Deirdre, Fitzpatrick, Ben, Ulster University; Hanna, Donncha, Queen's University; Breslin, Gavin, Ulster University

Background: Deci and Ryan (2000) propose that need-supportive social environments can motivate participation in physical activity and facilitate well-being. Few studies have tested self-determination theory (SDT) with children of social disadvantage. The aim of this study was to determine the influence of psychological needs (competence and social relatedness) on physical activity levels and well-being in children from social disadvantage across Ireland. Design: Baseline data from a clustered randomised control trial. Method: Children (n=211) aged 8-9 years from low socio-economic status completed an objective measure of physical activity and a questionnaire assessing psychological needs and well-being. Structural equation modelling (SEM) was conducted to confirm factorial validity and test for theoretically significant relationships between psychological needs, physical activity and well-being. Results: The construct validity of psychological needs and well-being instruments were supported. Further, SEM revealed support for SDT hypotheses. Namely, a significant positive relationship was found between athletic competence and physical activity. Athletic competence also positively predicted children's well-being, as did parental relatedness. Conclusions: Physical activity settings that support children's psychological needs for competence and relatedness may play a significant positive role in children's participation in physical activity and day-to-day psychological functioning. When attempting to increase physical activity and well-being practitioners should design interventions reflective of need-supportive environments.—*PhD Research Scholarship*

Assessing the impact of moving to inclusion (MTI) online

Sharma, Ritu, University of Toronto; McEachern, Brittany M., Queen's University; Arbour-Nicitopoulos, Kelly P., University of Toronto; Tomasone, Jennifer R., Queen's University

Moving to Inclusion (MTI) Online is an e-learning resource hosted by the Active Living Alliance for Canadians with a Disability (ALACD) that identifies general concepts, strategies and practical approaches for planning and delivering inclusive physical activity (PA) opportunities for persons with disabilities. This teaching tool has been implemented in classrooms across Canada since 2008. This study is the first to evaluate whether MTI Online improves users' knowledge about planning and delivering inclusive PA. A secondary objective of this study was to seek users' feedback on how to improve their learning experience while using the resource. Kinesiology and Physical Education undergraduate students from two Canadian institutions completed knowledge-based questionnaires on inclusive PA using FluidSurveys prior to (n=52) and following (n=14) exposure to MTI Online, and provided feedback on the content (e.g., clarity and credibility of information) and design (e.g., ease of use and navigation) of this tool in the post-questionnaire. An independent samples t-test indicated no baseline differences in knowledge between students with (n=41) versus without (n=11) experience working with persons with disabilities ($t(50)=.14$, $p>.05$). A significant improvement in users' (n=10) knowledge on inclusive PA was found from pre- to post-completion of MTI Online ($t(9)=2.25$, $p=.05$). Users indicated that the design was not aesthetically appealing, leading to feelings of disengagement while working through the resource. They also suggested embedding videos and activities within the resource to improve user-friendliness. These findings provide insight on how MTI Online can be redeveloped in the future to more effectively engage users in the resource.

The technical quality of online active living resources for people with physical disabilities
Shaw, Robert B., McMaster University; Mallory, Kylie D., University of Toronto; Arkell, Jane, Active Living Alliance for Canadians with a Disability; Martin Ginis, Kathleen A., McMaster University

Informational resources can play an important role in motivating and teaching people to become more physically active. Unfortunately, little is known about the quality of online physical activity, sport, and active living resources provided for people with physical disabilities. The objective of this study was to assess the quality of those resources. A purposive internet search was conducted to locate Canadian-developed resources that promoted physical activity, sport, and active living for people with disabilities. Community disability organizations across Canada were also contacted to obtain additional resources. Resource quality was evaluated using a modified version of the Journal of the American Medical Association benchmarks to assess technical quality of health information. Other pertinent information (e.g., descriptive characteristics, targeting strategies) were also assessed. Technical quality of resources was generally poor with a mean score of 3.57 out of a possible 7 points with only 56.2% of resources scoring above 4 points. Resources were easily accessed from their respective websites and the majority (76.1%) provided links to additional resources related to active living. A limited number of resources tailored their information for a specific disability (28.4%) and age demographic (36.4%), while no resources targeted their information to individuals based on how long they had a disability. This study highlights the concerning state of online resources for people with disabilities. Although the majority of resources provided evidence of authorship, other important aspects of technical quality were inconsistently included. Further research needs to be done to assess the use of theory and behaviour change strategies (e.g., goal setting, action planning) in online resources to alter key psychological constructs (e.g., self-efficacy) that are known to influence motivation for sport and physical activity.

Awareness and perceptions of relative age effects: A case study analysis
Sherman, Aubrey, Hancock, David J., Indiana University Kokomo

Relative age effects (RAEs) occur when athletes born at certain periods in the year are afforded participation or performance advantages over their peers (e.g., increased participation, fewer instances of dropout, selected to elite teams). This phenomenon is prevalent in youth, male, team sports. Generally, RAEs are believed to be a result of maturational differences, but this is not conclusive. Recently, in fact, researchers have suggested that the social agents (e.g., athletes, parents, and coaches) involved in sport have a larger impact on RAEs than maturation. The difficulty in making conclusive statements is that researchers often implement archival research (e.g., databases) to examine RAEs, which does not provide in-depth insights of the effect. The purpose of the present study, therefore, was to conduct interviews with participants to better understand their awareness and perceptions of RAEs. Participants included 10 competitive, youth hockey players (14-15 years). Additionally, we invited the parents of each athlete to participate in an interview. Each parental unit was treated as one participant, regardless of whether both parents were interviewed (therefore, n = 10). Questions were centered on awareness and perceptions of RAEs. The structured interviews (athletes: 7-15 minutes; parents: 11-30 minutes) were recorded and transcribed verbatim, allowing a content analysis of common themes. For awareness of RAEs, results indicated that none of the athletes had prior knowledge of RAEs, while most parents had such knowledge. In terms of perceptions of RAEs, athletes expressed a belief that players are often selected to teams based on physical characteristics rather than athletic ability. Similarly, parents believed RAEs were the result of relatively older athletes being more physically mature than relatively younger athletes. Notwithstanding, most athletes and parents believed that RAEs had not personally affected their/their child's chances of success in hockey. In the discussion, we highlight how these results help us understand RAEs in sport.

Exploring the sport pathways of military veterans with a physical disability
Shirazipour, Celina H., Latimer-Cheung, Amy E., Queen's University

Sport is a prominent tool used to promote the well-being of military veterans with a physical disability (PD). While research has been conducted regarding methods of introducing parasport, knowledge is lacking regarding long-term sport trajectories or what happens following initial parasport experiences. This study aims to understand the sport pathways of veterans with a PD from injury acquisition to the present. Eighteen veterans with a PD (Mage = 44.72; SD = 11.98) were recruited using maximum variation sampling for country, type of sport, disability, and method of

injury. Participants took part in two interviews. The first interview consisted of developing a timeline of their sport participation. The second interview explored psychosocial elements of their sport experiences. A thematic analysis was conducted to explore for patterns in pathways, and common factors influencing trajectories. Three main pathways were identified. The first pathway began with an introduction to sport during rehabilitation, which was followed by a competitive opportunity or program invitation. Participants then sought new challenges. In the second pathway, participants either had a vicarious experience or were invited to a Paralympic clinic. This experience was followed by opportunities for competition or new challenges. In both pathways, participants took on mentorship roles and sought opportunities for prosocial engagement. The final path consisted of individuals who continuously sought different programs. Timelines differed based on the type and method of injury. Individuals with recent combat injuries or traumatic injuries had immediate introductions to parasport, while those with non- combat injuries or progressive injuries had a longer period of time between onset of disability and being introduced to parasport. Challenge, belongingness, and mastery emerged as elements that fostered further participation beyond sport initiation. These findings provide new perspectives for understanding the sport experiences of veterans with a PD, and how to promote parasport involvement.

Effects of exercise on sadness and suicidal behavior in adolescents in different bullying environments

O'Neil, Linnae, Sibold, Jeremy, University of Vermont; Edwards, Erika, University of Vermont; Murray-Close, Dianna, Hudziak, James J., University of Vermont

The consequences of bullying are well described, and recent work from our group has demonstrated a robust, positive impact of exercise on sadness and suicidality in bullied adolescents. The purpose of this study is to examine the influence of exercise on sadness and suicidality in different bullying contexts (school vs electronic). We hypothesized that physically active students would be less likely to report sadness, suicidal ideation, and attempts, regardless of the type of bullying reported. Using the 2013 National Youth Risk Behavior Survey (N=13,583), regression models adjusted for age, sex, and race estimated the odds ratio between level of physical activity and sadness, suicidal ideation, and suicidal attempts, stratified by whether students were bullied electronically or on school property. Regardless of bullying environment, students who reported being bullied were twice as likely to report feeling sad, three times as likely to report suicidal ideation, and three to four times as likely to report suicide attempt. Students who were bullied on school property and who exercised 4 or more days/week had a 39%, 29%, and 28% reduction in the report of sadness, suicidal ideation, and suicidal attempt respectively ($p<0.01$). In students who reported being bullied electronically, exercise on 4 or more days/week did not have a significant effect on the report of sadness, suicidal ideation, or suicide attempt ($p>0.05$). These results suggest that exercise ameliorates sadness and suicidality in students who report being bullied at school, but not in those who are bullied electronically. This may be due, in part, to the pervasive, hard to escape nature of electronic bullying, and supports further research in this arena.

Lack of sex-based difference in long-term cognitive outcomes of concussion

Sicard, Veronik, Moore, Robert D., Ellemberg, Dave, University de Montreal

Intro- Despite increasing research in sport concussion and increasing participation of females in sport over the last decades, results regarding sex as a moderator of outcome following a concussion are conflicting and management guidelines remain uncertain. Purpose- To determine if there is a sex difference in the long-term cognitive outcome of athletes with a history of concussion (HOC). Methods- 196 collegiate athletes (49 HOC female, 49 HOC male, 49 female matched controls, 49 male matched controls) completed the Cogstate test battery to which a 2-back condition was added to increase our ability to detect persistent deficits in higher cognition. All participants were asymptomatic at time of testing and those with a HOC were 6+ months from injury. Results- No difference between sex was observed, for both control and HOC athletes, on the number of commission or omission errors, target and non-target reaction time and accuracy on any of the tasks ($ps>0.05$). However, irrespective of sex, HOC athletes exhibited a decreased accuracy relative to controls the n-back task ($p=0.01$), which requires multiple aspects of higher cognition. No group difference was observed for target or non-target reaction time ($ps<0.05$). Analysis failed to reveal any group differences on tasks measuring lower-level cognitive functions (Detection, Identification, Card Learning; $ps<0.05$). Conclusion- The current results suggest that beyond the acute phase of injury, sex does not

seem as a moderating variable of cognitive outcomes following concussion. Furthermore, the results reaffirm that concussive injuries can result in persistent deficits in aspects of higher cognition.

Childhood inhibitory control may predict adolescent physical activity and eating behaviors

Slutsky, Alexis, Janssen, James A., University of North Carolina at Greensboro; Kolacz, Jacek, Shanahan, Lilly, University of North Carolina at Chapel Hill; Calkins, Susan D., Lovelady, Cheryl A., Keane, Susan P., Dollar, Jessica M., Wideman, Laurie, University of North Carolina at Greensboro

Several longitudinal studies have assessed self-regulation at an early age and have shown it to be highly predictive of future outcomes up to 40 years later in constructs such as obesity, overall health status, academic achievement, risky behavior, and financial attainment (Moffitt et al., 2011). Given these findings, it has been surprising that physical activity (PA) and other health behaviors that require self-regulation skills have remained relatively unexplored. Our purpose was to investigate the association between childhood self-regulation and adolescent PA and eating behaviors. As part of a larger longitudinal study, self-regulation dimensions of inhibitory control and attentional focusing were assessed during childhood (4, 7, 10yrs) by the parent-reported Childhood Behavior Questionnaire (Rothbart, 2001). Then, at age 16, participants completed the Godin Leisure-Time Exercise Questionnaire (n=116) and 24-hr dietary recalls (n=155). Diet recalls were conducted using the Nutrition Diet System for Research (NDSR), with fruit intake and the Healthy Eating Index calculated for the analysis. Regressions were performed to predict PA and health behaviors from childhood self-regulation, with race and SES as covariates. We found inhibitory control at 4 and 10yrs predicted strenuous PA in females (OR=2.130, 1.975, p=0.004, 0.047), but not males (p=0.067, 0.61). Furthermore, inhibitory control at 10 years also predicted female fruit intake (p=0.006) and male Healthy Eating Index score (p=0.045). No relationship was observed for attentional focusing and PA, Healthy Eating Index, or fruit intake. This study provides initial evidence for childhood IC predicting adolescent health behaviors. However, this relationship may be dependent on gender and/or health behavior assessed. Maximizing the development of self- regulatory behavior, including inhibitory control, in early childhood, may affect adolescent health-behaviors and have potential implications for early-life obesity prevention programs.

More than one road leads to Rome: Meta-analysis of physical activity interventions on cognition in children

Smiley-Oyen, Ann L., Vazou, Spyridoula, Iowa State University; Pesce, Caterina, Italian University Sport and Movement; Lakes, Kimberley D., University of California, Irvine

A growing body of research indicates that physical activity (PA) positively impacts cognitive function in children. However, not all forms of PA benefit cognition equally. The purpose of this meta- analysis was to determine the effect of different types of chronic PA interventions on children's cognition. A systematic search of electronic databases and examination of the reference lists of relevant studies resulted in identifying 28 studies. Studies were included if the intervention was chronic, included a control group, targeted typically developing children or adolescents and measured cognitive outcomes. Seven categories of PA were identified, based on three types of PA (aerobic, motor skill, cognitively engaging). Four control conditions were identified: no treatment, physical education, academic and aerobic. Effect sizes were calculated based on means and standard deviations at the post-test using Cohen's d formula and weighted by accounting for sample size. One effect size per intervention and per condition was calculated in order to control for excessive bias. Full data were provided from 21 studies (32 effect sizes; n=2260 intervention; n=2225 control). Overall, chronic PA interventions had a significant small-to-moderate effect on cognition (g=0.41). Moderate significant positive effects were identified when PA interventions were compared to no treatment (g= 0.77, n=6), academic content (g= 0.57, n=10), and aerobic control conditions (g= 0.81, n=4), with high heterogeneity. A small non-significant effect was noted when PA interventions were compared to physical education (g= 0.09, n=10). Cognitive function benefited from all types of PA interventions, with the strongest effects being from cognitively engaging PA (g=1.47, n=3), or when combined with aerobic activities (g=0.60, n=10). We conclude that chronic PA interventions have a positive impact on cognitive function in children, but more systematic research is needed to better determine differences between types of interventions.

Body image discrepancies are related to reduced physical activity among early adolescents at risk for obesity: A polynomial regression model.

Solomon-Krakus, Shauna, Sabiston, Catherine M., University of Toronto; Henderson, Melanie, University de Montreal

The purpose of this study was to examine body image discrepancies as predictors of moderate to vigorous physical activity (MVPA) among 445 early adolescents (45% female; Mage=11.61, SD=0.92 years; MBMI=20.83, SD=4.64) with a family history of obesity. MVPA was objectively assessed with an accelerometer worn for 7 consecutive days and body image discrepancies were assessed using a figure-rating scale reflecting participants' perceived body shape (actual) and ideal body shape. Polynomial regressions were used to examine the associations between (dis)agreement and the degree of discrepancy between actual and ideal body shapes and MVPA. After controlling for sex and BMI, MVPA significantly (p=.04) decreased more sharply as the degree of the discrepancy between ideal and actual body shapes increased for both sexes. Furthermore, significant linear and nonlinear relationships were found between the agreement in actual and ideal body scores and MVPA (p=.01 and p=.03, respectively). Given these findings, intervention efforts for promoting physical activity among youth should target these body image discrepancies and other measures of body image dissatisfaction. Approaches for managing discrepancies include cognitive dissonance and cognitive behavioral therapy and these strategies should be explored in this vulnerable population.

The association between cardiovascular fitness and obesity in relation to inhibition function: An event-related potential study

Song, Tai-Fen, Liu, Jen-Hao, National Taiwan Sport University; Chi, Lin, Ta Hwa University of Technology; Chang, Yu-Kai, National Taiwan Sport University

The purpose of this study was to investigate the association of cardiovascular fitness and obesity on cognitive performances using both behavioral and electrophysiological approaches. A total of one hundred college students, aged 18-25 years, meeting the requisite criteria as determined by using body mass index (BMI) and maximal oxygen uptake (VO2max) were recruited. That is, participants were categorized into four groups: obese young males with high cardiovascular fitness (n = 25, i.e., OH) or low cardiovascular fitness (n = 25, i.e., OL), and normal-weight young males with either high cardiovascular fitness (n = 25, i.e., NH) or low cardiovascular fitness (n = 25, i.e., NL). Their N1 and P3 event-related potential (ERP) components were recorded while performing a Stroop test. Results revealed that OL group exhibited a longer reaction time relative to NH group for the congruent condition, and such difference was also observed for the incongruent condition of the Stroop test. Interestingly, for the incongruent condition, the reaction time of both OH and NL groups were shorter than OL group, and OL group had a longer N1 latency compared with the NL group. In addition, both obese groups had a smaller P3 amplitude relative to the NH group. These findings suggest that, in contrast to normal-weight young males with high cardiovascular fitness, obesity coupled with low cardiovascular fitness affects negatively the response inhibition aspects of executive functioning. Young adult obesity is associated with a decreased attentional resource allocation in the later stages of information processing. Regarding the early stages of information processing, beneficial influences from cardiovascular fitness could be moderating factors in both obese and normal-weight populations. The present study provides the evidence that increased cardiovascular fitness is a potential factor facilitating executive function in a younger obese population.

Teacher provision of relatedness support and student-peer relations in high school physical education

Sparks, Cassandra, Dimmock, James, University of Western Australia; Lonsdale, Chris, Australian Catholic University; Jackson, Ben, University of Western Australia

Studies utilizing a Self-Determination Theory framework have demonstrated the importance of relatedness support (RS) to students' motivation in physical education (PE). Much of this work has focused mainly on the teacher provision of RS (e.g., helpful, caring, supportive practices) and its relationship to students' motivation in PE. The classroom contains two social agents (i.e., teacher and peers) through which individuals may derive relational perceptions. Literature has linked teacher practices with positive peer interactions in general school settings, yet little work has explored the influence of teacher RS on students' interpersonal perceptions of their peers in PE.

Given the potential for teacher-derived RS to facilitate interpersonal relations between students, our aim was to explore how students' perceptions about their teacher directly/indirectly relate to students' relation-inferred self-efficacy (RISE), classroom connectedness, and PE self-efficacy and motivation. High school students (N = 536) from 27 classes completed questionnaires measuring teacher RS, peer-focused RISE, classroom connectedness, self-efficacy and motivation in PE. Path analysis (accounting for nesting) revealed a close fitting model, χ'' (79) = 310.94, p <.001, CFI = .95, TLI = .94, SRMR = .09, RMSEA = .07 (90% CI: .07, .08). Students' perceptions of their teacher's RS displayed positive direct effects on their peer-focused RISE beliefs (β = .60, p <.001), and classroom community perceptions (β = .71, p <.001), which both positively predicted students' PE self-efficacy (β = .63, p <.001 and β = .18, p <.001). Self-efficacy displayed positive direct effects on intrinsic motivation (β = .73, p <.001), identified regulation (β = .70, p <.001), and introjected regulation (β = .48, p <.001). Significant indirect pathways emerged between teacher RS and motivational contructs (via self-efficacy, classroom community, peer-focused RISE). These findings offer new insight into the potential influence of positive teacher practices on students' interpersonal perceptions about their peers in PE.

Do personal trainers discriminate against overweight clients? An experimental study.

Speed, Tyler N., Bopes, Jonathan P., Bendixen, Seth D., George, Megan, Strabala, Colin L., Mack, Mick, Fontana, Fabio E., University of Northern Iowa

The current levels of obesity in the United States are alarmingly high. Explicit and implicit anti-fat bias demonstrated by fitness trainers in previous studies may be a barrier for overweight clients to adopt exercise into their lifestyle. However, it is unknown whether anti-fat bias expressed by fitness trainers translates into discriminatory actions toward obese clients. The aim of the study was to compare exercise recommendations and behaviors of personal trainers toward an overweight and a normal weight client. Eleven trainers participated in the overweight (M age = 21.81; SD = 1.78) and eleven in the normal weight client condition (M age = 22; SD = 1.34). Trainers were asked to read a profile and watch a video interview of their respective client. Profiles (i.e. age, gender, cardiovascular endurance, health status) and video interviews (i.e. the faces of the two mock actors were distorted, and the voice, clothing, body position, and background were the same) of the overweight and normal weight clients were identical except for weight status. Trainers provided exercise recommendations for their respective client and answered the Attitude toward the Client Survey. The exercise recommendations were restricted to cycling on an upright ergonomic bike and consisted of the intensity and duration of the first session and the total minutes of the sessions in the remainder of the first week. The exercise goal of the client was to prepare for a 60-mile road bike race. Then, trainers were asked to bring a chair to a room where a mock client was waiting to be interviewed. The distance between the chairs of the trainer and client was measured. All dependent variables were assessed using independent t-tests. The intensity (p = .31), duration (p = .91), minutes/week (p = .76), attitude (p = .68) and chair distance (p = .23) were not significantly different between the overweight and normal weight client conditions. The results contradict previous studies measuring implicit anti-fat bias. Personal trainers did not discriminate against the overweight client.—*University of Northern Iowa, College of Education Undergraduate Research Grant*

Exploring the role of self-compassion in women athletes' emotionally painful experiences of injury in sport

Spencer, Nicole M., Kowalski, Kent C., Ferguson, Leah J., Erlandson, Marta C., University of Saskatchewan

Strong negative emotions, such as those elicited by athletic injuries, are related to poor decision making. Self-compassion has been endorsed as a resource for women athletes coping with injury and is purported to result in better health-related choices. The purpose of this study was to explore the role of self-compassion in women athletes' self-care behaviours following emotionally painful experiences of injury. Participants were female athletes (N = 159) aged 18-49 years who completed an online survey assessing various self-related variables as well as emotional and behavioural reactions to injury. Self-compassion was negatively related (all p < .05) to negative affect (r = -.26), threat appraisal (r = -.19), and an emotional pain composite score (EPC; r = -.18). Self-compassion did not contribute unique variance, beyond self-esteem and athletic identity, in the emotional reaction measures. The EPC was negatively related (all p < .05) to self-compassionate reactions (r = -.23), positive reactions (r = -.30), and perseverant reactions (r = -.16); and positively related (all p < .01) to ruminative reactions (r = .54), passive reactions (r = .24), and self-critical reactions (r = .48). The EPC was correlated (all p < .01) with stopping training (r = .34), reduced training frequency (r = .33), reduced training intensity (r = .27), and reduced training duration (r =

.33) but not with responsible reactions or stopping the session in which the injury was incurred. Athletes' open-ended descriptions of their self-care behaviours were coded into the following categories: diagnostics, rest, medical devices, pharmaceuticals, treatment, and training accommodations (with a mean of 3.38 reported behaviours). Self-compassion was not related to number of behaviours employed or use of any single behaviour. Overall, the results suggest that self-compassion plays a role in women athletes' injury experiences; however, likely due to the complex and multifaceted nature of injury, the relationships might not manifest in perfect concordance with theoretical conceptualizations.

To get involved or not to get involved: Normative influence on athletes' intentions to intervene in sport
Spink, Kevin S., Fesser, Kayla B., McLaren, Colin D., University of Saskatchewan

While research has revealed that descriptive norms influence individual activity (Priebe & Spink, 2015), no research has examined whether normative information can influence athletes' intentions to intervene with other teammates. However, research in other areas suggests that interventions using descriptive norms might be possible. Mollen et al. (2013) reported that manipulating descriptive norms increased individuals' motivation to intervene with others who were consuming excessive amounts of alcohol. This study examined whether descriptive norms that were either supported by a coach or not would influence player's intentions to intervene with teammates who had made technical errors or did not exert enough effort. Adult soccer players (N = 106) were recruited to participate in the online experimental study, and assigned to one of three conditions: teammates intervene/coach support (CS), teammates intervene/coach not support (CN), or attention control (C). Participants in the normative conditions (CS/CN) read separate vignettes describing how the players (e.g., 90% intervened) and the coach (e.g., encouraged players to either intervene or not) on a hypothetical soccer team responded to teammates' technical mistakes and lack of effort. While imagining themselves as a member of this hypothetical team, participants rated their intentions to intervene with other members of this team. Controlling for previous intervening behavior, ANCOVA results revealed a significant main effect for condition specific to technical mistakes, $p < 0.01$, $\eta p2 = 0.09$, with those in CS indicating greater intentions to intervene than those in C (adj Cohen's d = 0.71). Conversely, intention to intervene did not differ between those in the CN versus C condition (adj Cohen's d = 0.13). No significant difference emerged between the conditions in intentions to intervene following a teammate exhibiting lack of effort ($p > 0.1$). Results from this experiment provide initial evidence that descriptive norms supported by a coach may influence players to intervene when a teammate makes a mistake.—*Social Sciences and Humanities Research Council of Canada*

Self-control and physical activity among collegiate athletes
Stapleton, Jessie N., Josephs, Molly V., Missouri Baptist University

Self-control or self-regulation has been shown to be positively related to psychological well-being (Hofer, Busch, & Kurtner, 2011) interpersonal relationships (Tangney, Baumeister, & Boone, 2004) and exercise (Martin Ginis & Bray, 2010; Stork, Graham, Bray, & Martin Ginis, 2015) as well as negatively related to depression and stress (Park, Edmondson, & Lee, 2012) among college students. Although several studies have shown positive psychological and behavioral outcomes associated with self-control among college students, few studies have specifically focused on these relationships among collegiate athletes. As such, the purpose of this study was to examine the relationship between self-control and moderate-to-vigorous physical activity (MVPA) among collegiate athletes. Participants were 385 male and female NAIA athletes (Mage = 20.32 " 1.17). Athletes completed the Self Control Scale (Tangney, Baumeister, & Boone, 2004), the Habitual Self-Control Questionnaire (Schroder, Ollis, & Davies, 2013), and the Global Physical Activity Questionnaire (Armstrong & Bull, 2006) online via the Survey Monkey. Pearson correlations were conducted between both measures of self-control and MVPA. The Self Control Scale ($r = .03$, $p = .61$) nor the Habitual Self-Control Questionnaire ($r = .22$, $p = .07$) were significantly related to MVPA. These results indicate that self-control is unrelated to MVPA among collegiate athletes, which is contrary to previous research among non-athlete college students (Stork, Graham, Bray, & Martin Ginis, 2015). A possible explanation for this null finding may be that unlike non- athletes, collegiate athletes' MVPA is not volitional. Collegiate practices and games are mandatory activities that do not rely on self-control for participation. Future research should examine this relationship over the course of a collegiate career as well as examine the relationship between self-control and other behavioral and psychological outcomes among collegiate athletes.

Patterns in previous event sequences influence anticipation of serves in tennis
Stern, Ricarda, Loffing, Florian, Hagemann, Norbert, University of Kassel

When anticipating opponents' action intentions in sports, athletes may rely on both kinematic and contextual cues, e.g., findings suggest that outcomes of preceding events influence anticipation in sport situations (Loffing, Stern, & Hagemann, 2015). Here we examined whether patterns in previous serve-sequences of different lengths affect tennis serve outcome anticipation. To this end, 30 male tennis players (age: M = 26.13 yrs, SD = 5.24) and 30 male novices (age: M = 23.97 yrs, SD = 2.85) watched videos of tennis serves stopping 40ms after (non-target trials) or at (target trials) racket-ball-contact and were asked to predict serve direction (left vs. right) as accurate and fast as possible via key press. Serves were presented in blocks of six, each containing one target trial where identical serves were presented to control kinematics. In half of the blocks, the 3rd trial served as target trial, and the outcomes of the preceding two serves were manipulated under four conditions: two serves to the right (R) or left (L), RL or LR. In the other half, the 5th trial served as target trial; correspondingly, the preceding four serves were varied: RRRR, LLLL, RLRL, LRLR. A 2 (skill) x 2 (length) x 2 (congruence) x 4 (previous pattern) mixed ANOVA on percentage of correct side prediction in the target trials revealed a main effect for Congruence, $F(1, 58) = 43.01$, $p < .001$, p.-eta^2 = .43, and a Length x Congruence interaction, $F(1, 58) = 5.62$, $p = .021$, p.-eta^2 = .09. Accuracy was higher in congruent (M = 67.3%, SD = 1.6%) than incongruent target trials (M = 55.2 %, SD =1.3%); i.e., participants tended to expect a serve pattern to continue (e.g., serve to R after RR or RRRR) rather than to break (e.g., serve to L after R or RRRR). The effect was larger in trials preceded by four as opposed to two serves. The absence of a skill effect tentatively argues for the need of a further breakdown of anticipation-relevant contextual cues into skill-dependent (e.g., on-court position; Loffing & Hagemann, 2014) and skill-independent (e.g., patterns in prior sequences) cues.

Preliminary findings from a comparison of the affective responses to acute interval exercise and endurance exercise among sedentary adults.
Stork, Matthew J., Martin Ginis, Kathleen A., McMaster University

Exercise physiology research has advocated the use of interval exercise as a time-efficient exercise alternative. Although interval exercise can elicit important physiological benefits (e.g., Gibala et al., 2014), psychologists must question whether these protocols should be promoted to a largely sedentary population. To date, it is not known which interval exercise protocols are perceived most favorably by sedentary individuals. Purpose: To compare the affective responses to acute bouts of moderate-intensity continuous exercise (MICT), high-intensity interval exercise (HIIT), and sprint interval exercise (SIT) among sedentary adults, and to determine their preferred protocol. Method: Five sedentary men and women (20"1 y; BM=66"7 kg; HRmax=184"8 bpm; VO2max=26.5"3 ml/kg/min), unfamiliar with interval exercise, completed three acute exercise protocols: MICT, HIIT, and SIT. Heart rate, power output, revolutions per minute, ratings of perceived exertion, affect and felt arousal were measured throughout the exercise protocols. Following completion of the protocols, exercise preference was reported. Graphical representations of the data were used to observe changes in the dependent measures over time across the three protocols. Results: Graphs revealed that affect tended to drop more negatively over time during HIIT than SIT or MICT, but patterns of change in affect were similar in SIT and MICT. A rebound to more positive affect was experienced immediately following all three protocols. Further, felt arousal tended to be higher during the HIIT and SIT protocols than during the MICT protocol and dropped immediately following all three protocols. Of the three protocols, 60% of participants preferred HIIT, 40% preferred MICT, and 0% preferred SIT. Conclusion: This pilot data provides a novel understanding of acute changes in affect and arousal that occur over time during interval and endurance exercise. This research will help determine which exercise protocol(s) sedentary individuals perceive most favorably and may be most likely to adhere to in the long term.

Risk taking behaviors of male and female students in sport and daily life
Stuntz, Cheryl P., St. Lawrence University; Belanger, Josee M., Laurentian University

While some studies show athletes take more risks in daily life, including drinking, smoking and sexual behaviors, than non-athletes (e.g., Frye, Allen & Drinnon, 2010; Wetherill & Fromme, 2007), Johnson, Eisenberg, Bearinger, Fulkerson, and Sieving (2014) found that male athletes reported less substance use and safer sexual practices and

female athletes reported less sexual activity than non-athletes. Within sport, men generally take more risks than women (e.g., Boheim & Lackner, 2015). While research has not yet examined if athletes' risk taking differs between sport and daily life contexts, athletes are more accepting of aggression and use lower levels of moral reasoning in sport than in daily life (Bredemeier & Shields, 1984; Gardner & Janelle, 2002). This study examined whether (1) the relationship between athlete status and risk-taking in daily life differed by gender and (2) athletes' risk taking varied by context and by gender. Participants (N = 274) included male and female collegiate athletes and non-athletes who completed surveys. Female athletes and male athletes reported very similar propensity for risks in daily life. Male athletes reported lower propensity for risks in daily life than male non-athletes, and female athletes reported higher propensity for risks in daily life than female non-athletes. Also, male non-athletes reported consuming alcohol and marijuana more frequently than male athletes, while female athletes and female non-athletes consumed similarly. Male athletes were less likely to drive after drinking than male non-athletes, and female athletes were more likely to drive after drinking than female non-athletes. No gender differences were apparent in athletes' general propensities for risk in sport and in daily life contexts, and both male and female athletes reported greater risk-taking tendencies in sport than in daily life contexts. For males, participating in sport may serve as a protective factor regarding risks in daily life, while for females, participating in sport may increase risk-taking in daily life.

Testing the face validity and reliability of a modified SIT-Q 7 day recall questionnaire measuring sedentary time and break frequency & duration.

Sui, Wuyou, Western University

Sedentary behaviour (SB) is positively associated with a broad spectrum of chronic diseases, independent from moderate-vigorous physical activity. Self-report SB questionnaires are the most commonly used to assess sedentary time given the ease of administration, and significantly lower cost in comparison to objective measures (i.e. inclinometry). Almost every self-report instrument assesses sitting time as a primary measure; however, research suggests that frequency and duration of breaks taken from sitting also play essential roles in attenuating the consequences of prolonged sitting (Howard et al., 2013). To the author's knowledge, no self-report instrument that reliably measures domain specific break frequency and duration exists. This study sought to develop a valid and reliable self-report SB questionnaire by modifying an existing instrument (i.e. SIT-Q 7d) for measuring total and domain specific SB (Wijndaele et al., 2014) to include the frequency and duration of breaks from relevant section/domains of SB, and to test the modified questionnaire for face validity and reliability. The existing SIT-Q 7d was used as the base questionnaire; break frequency and break duration related questions were then added to pertinent sections of the questionnaire. Using this modified SIT-Q 7d questionnaire, 20 participants were recruited to test its validity and test-retest reliability. Participants filled out the new questionnaire twice: once during the initial meeting, and again 7 or more days afterwards. Within participant data was analyzed, and primary outcome measures of domain specific break frequency and break duration were highly correlated. SB research has shown the value in taking frequent and longer breaks from prolonged sitting for improving positive health outcomes. With increasing evidence highlighting the health benefit of breaking up existing SB, having a self-report instrument that can reliably measure frequency and duration of breaks from sitting in specific domains will become increasingly important for guiding future interventions.

The effect of interpersonal synchrony on endorphin levels in a non-vigorous task

Sullivan, Philip, Marini, Mat J., Razavi, Parmida J., Blacker, Mishka J., Brock University

Synchronized behavior between two or more individuals has a significant effect on its participants. Specifically, synchrony affects participants' endorphin levels (Cohen et al., 2010), and this has been shown to affect various outcomes such as cooperation and cohesion (Wiltermuth & Heath, 2009). To date, this synchrony effect has been mostly seen in vigorous synchronized activities, particularly rowing (Sullivan & Rickers, 2013). The purpose of this study was to see if synchronized non- vigorous activities would also show elevated endorphin levels. Participants were 24 high school cadets. They marched in step for 5 minutes under both solitary and group conditions. Conditions were counterbalanced. Pain threshold was taken as an indicator of endorphin levels immediately prior to and after both sessions. A paired sample t test showed that there were no significant differences in changes in pain threshold between the two conditions ($t(23) = 0.15$, $p > .05$). These results suggest that only vigorous activities such

as rowing may produce this synchrony effect on pain threshold. However, it is still possible that less vigorous activities such as marching could still induce cooperation and other social outcomes.

Experimental effects of variety support on exercise-related well-being

Sylvester, Benjamin D., University of British Columbia; Lubans, David R., Eather, Narelle, University of Newcastle; Standage, Martyn, University of Bath; Wolf, Svenja, University of Amsterdam; McEwan, Desmond, Ruissen, Geralyn R., Kaulius, Megan, Crocker, Peter R. E., Beauchamp, Mark R., University of British Columbia

Recently, researchers have found that the experience of variety in exercise predicts variance in indices of exercise-related well-being over time (Sylvester et al., 2014). The purpose of this study was to experimentally examine the extent to which variety support in a resistance exercise program influences exercise-related well-being among inactive adults. In addition, we also sought to examine whether the experience of variety explained (mediated) these potential effects. A sample of 121 inactive university students were randomly assigned and participated in either a high or low variety support, 6-week exercise program. Measures of exercise-related perceived variety, positive affect, negative affect, and subjective vitality were completed at baseline, after 3 weeks, and after 6 weeks (i.e., post-test). Through use of structural equation modeling, the results showed that for those who completed measures at post-test (i.e., n = 55), and for all participants who received variety support (i.e., a modified intention-to-treat analysis; N = 121), exercise-related variety support indirectly explained higher levels of exercise-related positive affect (R2 = .41 and .17 respectively), and subjective vitality (R2 = .37 and .24 respectively), and lower levels of negative affect (R2 = .45 and .18 respectively), through the mediating role of perceived variety. Overall, the provision of variety support in a resistance exercise program influenced exercise-related well-being through perceptions of variety. Providing variety support may be an efficacious method to promote exercise-related well-being in people who are physically inactive.*—SSHRC, UBC Four-Year Fellowship, Michael Smith Foundation for Health Research*

The role of grit in sport expertise development: Preliminary analyses of factor structure, validation of the Grit Scale in sport, and associations with practice and skill level.

Tedesqui, Rafael A. B., Young, Bradley W., University of Ottawa

To develop expertise, athletes must persist in long-term deliberate practice (DP; Ericsson et al., 1993). Grit refers to the tendency to work hard toward long-term goals, maintaining effort and interest over years despite failure, adversity, and plateaus in progress (Duckworth et al., 2007). Despite its predictive validity in educational and occupational achievement domains (Eskreis-Winkler et al., 2014), minimal work has examined grit in the sport expertise domain and none has validated the Grit Scale in sport. Two hundred and thirty-seven athletes (128m, 109f, ages 12-43; Mpractice=14.09 hrs/wk, SD=8.69) completed the 12-item Grit Scale (Duckworth et al.), and reported DP amounts and skill level (local to international). Using AMOS, we first tested the factor structure of the Grit Scale. Fit indices of a two-factor ("perseverance of effort"; "consistency of interests") measurement model showed poor fit ($\chi2 = 149.05$, $p < .001$, CFI = .86, RMSEA = .09). Consequently, exploratory factor analyses (direct obliminal) were performed and, after iterative deletion of problematic items (2 for perseverance of effort, 1 for consistency of interests), a two-factor solution resulted (cum variance 42.1%): consistency of interests (5 items; 29.5%; $\alpha = .80$) and perseverance of effort (4 items; 12.6%; $\alpha = .70$). Next, we tested this resultant model through confirmatory factor analysis in AMOS and fit indices showed good fit ($\chi2 = 41.84$, $p < .05$, CFI = .97, RMSEA = .05). Finally, we submitted both scale scores to tests of concurrent validity in the sport expertise framework, i.e., correlations with DP and tests of skill-group differences. Perseverance of effort correlated with DP ($r = .31$, $p < .001$) and a highly-skilled group (nat and international; M = 4.45, SD = .55) had a higher tendency to persevere in long-term goals than a less-skilled group (local, city, regional, and prov; M = 3.91, SD = .70), $p < .001$. These findings suggest that the tendency to work hard toward long-term goals enables athletes to persist with practice activities that are pivotal to expertise development.

The internal-external frame of reference model in sport

Tietjens, Maike, University of Muenster; Moeller, Jens, University of Kiel; Lohbeck, Annette, University of Oldenburg

This study used Marsh's (1986) internal-external frame of reference model to analyze relations between performance and perceived ability in different sports on the basis of social and dimensional comparison processes. It is a replication study of Tietjens, Möller, and Pohlmann (2005). Positive relations are expected for university grades and self-concepts of related sports (e.g. Basketball, Handball) and negative relations for relatively autonomous sports (e.g. soccer, gymnastics). 289 sport science students (range 19-29 years, M=24.22 year, SD=2.03, male 49.6% female 51.4%) from different universities completed a questionnaire assessing perceived abilities (0 = disagree to 5 = totally agree) and university grades (6 = very good to 1 = failed (recoded)) in individual sports (gymnastic, swimming, track and field) and team sports (handball, basketball, soccer). As expected positive correlations between performance and perceived ability within each sport ($.41 \leq r \leq .58$, $p<.001$; $133<n<189$) were found. Significant positive correlations were found between university grade in soccer, handball, basketball and track and field, and between gymnastic, swimming, and track and field ($.16 \leq r \leq .32$, $p<.001$; $51<n<106$). A similar pattern was found for perceived abilities (soccer, handball, basketball and track and field, ($.16 \leq r \leq 43$, $p<.001$; $280<n<283$). Significant positive correlations were found between university grades in basketball and perceived ability in handball ($r=.29$. $p<.001$). But negative correlation were found between university grades and perceived ability in basketball-gymnastic and soccer-gymnastic, soccer-swimming ($-.33 \leq r \leq -.22$, $p<.001$; $82<n< 56$). Sports that are perceived of being in the same domain show assimilation effects between performance and perceived ability. Good grades in basketball are related to a higher self-concept in handball, whereas sports that are perceived from different domains show contrast effects. Future sport research should take inter- and intra -domain comparison processes into account when analyzing self-concept development.

Stereotypes for action? Use of the "athlete stereotype" and its possible effect on people with disabilities

Todd, Kendra R., Perrier, MJ, McMaster University; Latimer-Cheung, Amy E., Queen's University; Smith, Brett, University of Birmingham; Martin Ginis, Kathleen A., McMaster University

People with disabilities are often stereotyped as more friendly, yet less competent than people without disabilities. Given the potential implications of this athlete stereotype, the objective of this project was to identify how the athlete stereotype is interpreted by both athletes and non-athletes with a disability and how elements of this stereotype are incorporated in stories they share with others. Eighteen participants with disabilities (6 competitive; 8 recreational; 4 non-athletes) engaged in semi-structured interviews (45 -60 min). All interviews were transcribed verbatim and subjected to a dialogical narrative analysis. Participants constructed Paralympic athletes as those who are similar to Olympic athletes competing at the highest possible level in their respective sports. They were described as committed, focused, strong, and agile. In contrast, recreational athletes were constructed as people who were strong, but primarily involved in sport for fun and social experiences. Participants felt the need to share these characteristics and their experiences with people without disabilities to counteract the belief that Paralympic athletes were inspiring, courageous and admired for living despite disability. While elite athletes felt that this athlete stereotype would be motivating to non-athletes, recreational athletes and non- athletes felt this stereotype could be discouraging and further turn people with disabilities away from sport. While telling their stories, elite level athletes purposefully employed the athlete stereotype to construct an image of strength, competence, and commitment, thus reinforcing this stereotype may have benefits to those who engage in sport. However, it may create pressure and negative effects for people with disabilities who choose not to participate in sport.

A RE-AIM evaluation of a telephone-based leisure time physical activity counseling service for adults with spinal cord injury

Tomasone, Jennifer R., Queen's University; Arbour-Nicitopoulos, Kelly P., University of Toronto; Estabrooks, Paul A., University of Nebraska Medical Center; Latimer-Cheung, Amy E., Queen's University; Martin Ginis, Kathleen A., McMaster University

Get in Motion (GIM), a 6-month evidence- and theory-based telephone counseling service, promotes leisure-time physical activity (LTPA) participation among Canadian adults with spinal cord injury (SCI). The purpose of this

study was to use the RE-AIM framework to evaluate GIM's Reach, Effectiveness, Implementation, and Maintenance. Clients (n=46; 50% male; 50% paraplegia; 51.46"12.36 years old) attended 5.93"4.01 sessions with a total contact of 103.11"71.66 mins, on average, and were representative of the Canadian adult SCI population with the exception of sex, primary mode of mobility, and geographic location. There were no significant demographic differences between service completers (n=25) and drop outs (n=21). Clients' high initial LTPA intentions were sustained (all Fs(2,30)≥0.69, ps≥.24) while LTPA significantly increased (all Fs(2,40)≥3.68, p≤.03) with a greater proportion of clients meeting guideline-level aerobic LTPA at service completion (52%) than at enrollment (19%, McNemar X2=3.00, p=.05). High perceptions of quality of life did not change over the service (t(17)=-0.54, p=.59). Negative health outcomes were unrelated to clients' service or LTPA participation. During implementation, counseling session checklists indicated that informational strategies were discussed significantly more frequently than behavioral strategies (t(45)=3.82, p<.001). Clients had positive perceptions of the information and resources provided and of their interactions with the counselor. Six months after GIM completion, maintenance measures indicated that there were no significant changes in clients' intentions, LTPA and quality of life (ps≥.17), and long-term negative health outcomes remained unrelated to service or LTPA participation. These findings suggest that GIM has reasonable Reach, Effectiveness, and Maintenance at the participant level, but that behavioral strategy Implementation fidelity could be addressed in future iterations. The methods used in this study provide a template to assess the impact of other LTPA-promoting services implemented in practical settings.—*Rick Hansen Institute; Ontario Neurotrauma Foundation*

Implicit attitudes toward sports and academic activities among junior high school students, Parents, and Teachers

Tseng, Hui-Shan, Gau, Li-Shiue, Asia University, Taiwan

The purpose of this study is to examine participants' implicit attitudes toward sports and academic activities at junior high schools in Taiwan by means of the Implicit Association Test (IAT). Possible adjectives associated with sports and academic activities were developed through two stages. In the first stage, 57 junior high school students participated in brain-storming to get 32 positive and 32 negative adjectives. In the second stage, 59 junior high school students rated the 64 adjectives. The highest 20 positive and 20 negative adjectives were retained in the consequent test. Greenwald's free online IAT was revised and adopted. Participants were asked to associate Positive adjectives with Sports and Negative adjectives with Academic terms (PSNA). The total response time of PSNA was recorded. Then, participants were asked to associate Positive adjectives with Academic terms and Negative adjectives with Sports (PANS). The total response time of PANS was also recorded. PSNA and PANS were compared. If PSNA is shorter than PANS, this indicates more preference of the attitude toward sports, whereas if PANS is shorter than PSNA, this indicates more preference of the attitude toward academic activities. The test was administrated to a total of 132 participants at 11 junior high schools in northern (4 schools), middle (4), and southern (3) Taiwan, including physical education teachers (33 participants), academic subject teachers (33), students (33) and students' parents (33). The results showed that parents tend to associate positive adjectives with academic activities quickly in shorter time than sports activities, indicating more positive attitudes toward academic activities. Results also show parents have more positive attitudes toward academic activities than their children (students) do. Parents may think academic activities are more important than sports activities to prepare their children's future career. Further analysis shows that the attitude difference between parents and children gets smaller when the score of parent- children interaction is higher.

Observing coaches' leadership behaviours in sport: The development of the coach leadership assessment system (CLAS)

Turnnidge, Jennifer L., Cote, Jean, Queen's University

Previous research consistently highlights the important role which coaches' leadership behaviours play in shaping the quality of youth's sport experiences (Chelladurai, 2007). It has been recognized, however, that the sport psychology literature may benefit from the adoption of novel approaches to leadership research (Rowold, 2006). Moreover, existing research has predominantly assessed leadership behaviours via questionnaires and interviews (van der Weide & Wilderom, 2004). The purpose of the present study was to develop and validate an observational coding system that captures coaches' leadership behaviours in sport. Drawing from an integration of the dimensions

emphasized within the full-range leadership model, and particularly, transformational leadership (TFL) theory (Bass & Riggio, 2006), the Coach Leadership Assessment System (CLAS) was designed to provide an objective assessment of coaches' leadership behaviours. Behavioural categories were developed through an iterative combination of literature review, qualitative interviews, and video observation. The CLAS consists of five higher-order dimensions: Transformational, transactional, neutral, laissez-faire, and toxic leadership tones, which assess coaches' leadership across 18 distinct behavioural categories. The coding system also analyzes coaches' leadership behaviour in relation to the content (instruction/feedback, organization, and general communication), recipient, and context. A coder training protocol was implemented to ensure that coders consistently met a minimum standard of 75% for both inter- and intra- rater reliability. Several strategies were also employed to assess the content, concurrent, and predictive validity of the CLAS. Overall, results provided preliminary support for the reliability and validity of this instrument. Findings also demonstrated that the CLAS can provide a detailed and contextualized account of coaches' leadership behaviours in sport and that this tool may have important implications for theory development and applied practice.

Qualitative and quantitative validity evidence for a state mindfulness measure for youth

Ullrich-French, Sarah, Cox, Anne E., Cole, Amy N., Cooper, Brittany, Gotch, Chad, Washington State University

Mindfulness is awareness and attention to the present moment with non-judgment and acceptance (Bishop et al., 2004). In addition to associations between trait mindfulness and indicators of well-being, recent evidence supports a positive association between state mindfulness and state intrinsic motivation during physical activity (Cox et al., 2016). There is initial evidence of the positive role of mindfulness during physical activity in adults using a new physical activity-focused measure (SMS-PA; Cox et al., 2016), but no youth research exists. This study used qualitative and quantitative methods to examine the validity of the SMS-PA for youth. In phase 1, children (N = 15) ages 8 to 14 participated in a yoga session followed immediately by cognitive interviews regarding SMS-PA items. The items comprise two subscales representing two objects of mindful attention: body- related and mind-related events. Inductive content analysis of the transcribed interviews suggests high variability in comprehension of items; younger children had more difficulty articulating valid responses to some items. In phase 2, middle school students (N = 481, Mage = 12.88, SD = .95) completed one of two randomly assigned versions of the SMS-PA immediately following physical activity. Version A (n = 236) was the original measure and version B (n = 245) was a modified measure using wording tested in the cognitive interviews. Both versions demonstrated adequate reliability for the mind (α= .86-.87) and body (α= .86-.88) subscales. Two factor CFAs show adequate fit for versions A (CFI = .91, SRMR = .06) and B (CFI = .90, SRMR = .06) with strong item loadings. Both versions correlated ($p < .01$) with intrinsic motivation (r = .34 - .47) and engagement (r = .45 - .65). Initial evidence of content and construct validity, of similar quality, was found for both measures with adolescents. Based on cognitive interview data, caution is noted in using the original SMS-PA measure with younger children. The SMS-PA shows promise for use with adolescents and further research is encouraged.

An exploration of Keyes' two-continuum model of mental health in athletes: resilience, mental illness and performance.

Uphill, Mark A., Sly, Daniel, Swain, Jon, Canterbury Christ Church University

Keyes' (2005) two-continuum model of mental health posits two related, but distinct dimensions (1: the presence or absence of mental health – MH; 2: the presence or absence of mental illness - MI). Theoretically, athletes could experience both positive MH and symptoms of MI. Alternatively, athletes could be free from MI, but experience low levels of MH (what Keyes, 2005 terms languishing). This study presents preliminary results from an online survey examining (a) associations between resilience, MH, and MI, and (b) associations between MH, MI and performance. Participants comprised (male, n = 29; female, n = 28) athletes from a range of team (e.g., soccer, netball) and individual (e.g., triathlon, golf) sports (mean age = 23 ± 7 years). The survey comprised measures of MH (Keyes et al., 2008), MI (Connell et al., 2007), resilience (Wagnild & Young, 1987), and performance [the mean of 3 items assessing satisfaction in training, competition, and in sport generally from 0 (totally dissatisfied) to 100 (totally satisfied)]. Using proposed cut-off criteria (Connell et al, 2007; Keyes et al, 2008), some individuals (12%) reported both severe MI and high MH. In addition, a modest, negative relationship (r = -.40, p = .003) between MH and MI lends some support to Keyes' model. Resilience (personal competence) was associated with

MH (r = .50, p < .01), and MI(r = -.34, p = .01). Resilience (acceptance of self and life) was not associated with MI (r = -.24, p = .08), but was associated with MH (r = .39, p = .003). Zero-order correlations between MH and performance (r = .63, p < .001), and MI and performance (r = -.40, p = .003) are qualified by partial correlation analyses. The correlation between MH and performance remains significant when MI is controlled for (r = .59, p < .001). When MH is controlled for, the relationship between MI and performance (r = -.05, p = .76) is attenuated. Collectively, results provide some support for Keyes' model and for considering MI and MH as separate factors influencing sport performance.

Body-related emotions and their associated influence on physical activity motives and behavior and physiological stress in breast cancer survivors

Vani, Madison, Sylvester, Ben, Sabiston, Catherine M., University of Toronto

Breast cancer survivors (BCS) are at risk for negative body image emotions from treatment side effects. Drawing from empirical findings and theoretical tenets, negative body-related emotions may be associated with controlling physical activity motives and low levels of physical activity (PA), which may also be related to stress outcomes. The purpose of this research was to explore associations between body-related emotions (i.e., guilt and shame), PA motivation (i.e., external, introjected, and autonomous motives) and behavior (i.e., moderate-to-vigorous PA), and physiological stress (i.e., cortisol) in BCS. Women (N = 171; Mean Age = 55 years; within six months of completing primary treatment for breast cancer) provided self-report measures, ten saliva samples over two days, and wore accelerometers for a week. The associations were tested in structural equation modeling, controlling for age, body mass index, and stage of cancer. The path model coefficients were chi^2 (16) = 27.5, p = .04, RMSEA = .09 (90% CI = .05-.14), CFI = .96, SRMR = .04. The body-related emotions predicted significant variance in external (R^2 = .13), introjected (R^2 = .35), and autonomous (R^2 = .06) motives. Significant (p < .05) path coefficients included: guilt positively associated with introjected and autonomous motives; shame positively associated with external motive and negatively associated with introjected and autonomous motives; introjected motive and PA behavior positively associated with cortisol (R^2 = .20). These results highlight the importance of understanding body-related emotions and their associated links as their effects may harm BCS' health and wellbeing.

Athlete responses to managerial change in sport

Wagstaff, Christopher RD., Thelwell, Richard C., University of Portsmouth

This study explored athletes' responses to manager change in sport organizations. Data were collected via semi-structured interviews with 16 athletes from two organizations competing in English football's Barclays Premier League. The results indicated that athletes respond to repeated organizational change in positive and negative emotional, behavioral and attitudinal ways. The main positive response themes related to: resilience, learning, performance, challenge appraisals, and autonomy. The main negative response themes related to: trust, cynicism, motivation, turnover, engagement, performance, and commitment. The findings illustrate the value of exploring and monitoring employee responses to managerial change. Specifically, the data indicate increasingly deteriorating athlete attitudes across change events, but also highlight the important role of cognitive appraisal for responses to such events. The results have implications for organizational psychology in sport research and practice in dynamic contexts such as elite sport.

The peer climate and achievement motivation in physical education: A longitudinal perspective

Warburton, Victoria E., University of East Anglia

Background: Much of the research on the motivational climate in Physical Education (PE) has focused on the teacher as the key social agent. This paper presents the first data on the effect of peers on the motivational climate, and to changes in motivation in the PE context. Objective: To examine the effect of perceptions of peer and teacher climates on changes in pupils' motivation over the course of a school year. Specifically, 1) to establish the temporal patterns of, and gender differences in, pupils' perceptions of teacher and peer climates. 2) To determine the predictive utility of perceptions of the teacher and peer climate to changes in pupils achievement goal adoption. Design: Longitudinal design. Method: 655 pupils aged 11-14 years completed a questionnaire assessing perceptions

of teacher and peer climates and approach-avoidance goal adoption on three occasions during a school year. Established measures of each variable were used. Multilevel analyses were employed to test a series of sequential models examining the effect of the peer climate on each achievement goal when controlling for gender and the teacher climate. Results: Perceptions of the teacher mastery climate decreased, while perceptions of the peer performance climate increased over time. Males had higher perceptions of peer and teacher performance climates at the start of the study but there were no differences over time. Finally, the addition of the peer climates and the associated interactions with time explained more variance in the initial status and rate of change of performance-based goals. For example, for performance-approach goals, the amount of variance explained in initial status increased from 19% to 42% and from 17% to 78% for the rate of change. Conclusions: Examining the effects of peers on the motivational climate is important to provide a more comprehensive account of influences on the quality of pupils' motivation in PE, particularly in relation to performance-based goals. This has implications for future research, the designing of interventions and for PE practice.—*British Academy*

Self-regulatory fit: Person, situation, and instruction interactions in sport

Wegner, Mirko, Gretzer, Ramon, University of Bern; Budde, Hennig, Medical School Hamburg; Schueler, Julia, University of Bern

Self-regulation processes support goal striving and have been previously investigated in sport science. Different theories on self-regulation propose two self-regulatory modes: an approach mode and an avoidance mode. In four studies we investigated whether a fit between a chronic self-regulatory mode and a situational or instructional framing benefits sports performance. In Study 1, sport students performed ten shots on a mini basket. They either received an avoidance or an approach instruction. In Study 2, a control condition was added to the avoidance and approach instructions. Sport students performed two times ten basketball shots from free throw distance. Study 3 was a field study with high-performance badminton players in which we investigated whether being ahead or behind in real competitive matches interacts with a person's chronic self-regulatory focus to predict performance. In Study 4, the chronic self-regulation focus x situation x coach's instruction interaction was tested with volleyball players performing a service defense (avoidance) or smash defense (approach) task. Chronic self-regulation was assessed using a regulatory focus questionnaire and an action orientation questionnaire. Results in Study 1 illustrate that sport students with a chronic avoidance focus benefit regarding their performance in the basketball task when they receive an avoidance instruction. In Study 2, only approach-oriented individuals improved their performance in the control condition when they did not receive any instruction (instructio x focus). In Study 3, being ahead or behind (situation) interacted with the individual difference in self- regulation with avoidance-oriented individuals showing better performance when being ahead and approach-oriented persons' performance benefiting from being behind. In Study 4, only a chronic self-regulation x instruction interaction could be observed. Approach-oriented players benefitted from approach instructions and avoidance-oriented from avoidance instructions.

Commitment and expectancy-value constructs predicting motivated achievement behaviors

Weiss, Windee M., University of Northern Iowa

According to the sport commitment model, specific constructs should predict level of commitment to continue an activity, which in turn predicts actual commitment behaviors, such as training intensity and effort (e.g., W. M. Weiss et al., 2010). Additionally, Eccles" expectancy value model contends that expectancies for success and task value also lead to achievement or motivated behaviors (e.g., Eccles, 1983). Female gymnasts (N = 286; ages 8-17 years, M = 11.12, SD = 2.14) competing in Levels 4-10 in USA Gymnastics completed measures designed to assess their perceptions of sport commitment constructs, expectancies of success, and subjective task value. Additionally, coaches for each gymnast completed measures assessing the coaches' perceptions of the gymnasts' training behaviors and perceptions of the gymnasts' overall ability or expectations for success in gymnastics. A series of multiple regressions were conducted to determine the significant predictors of coaches' perceptions of training behaviors and perceived expectancies of success. Sport commitment constructs were first analyzed to predict gymnasts' training behaviors and coaches' expectancies for success, and both regressions were significant: F (10, 276) = 2.97, p < .01, R2 = .10 and F (10, 284) = 2.51, R2 = .08, respectively. Lower enjoyment (beta = -.27) and higher benefits (beta = .20) significantly predicted higher rated training behaviors, whereas lower attractive alternatives (beta = -.19) and teammate social constraints (beta = -.18) and higher coach social constraints (beta =

.27) significantly predicted higher coaches' expectancies of success. In relation to the expectancy-value constructs, only the regression predicting coaches' expectancies for success was significant: F (4, 281) = 7.95, R2 = .10. Only gymnasts' expectations for success (beta = .33) significantly and positively predicted coaches' expectancies of success.—*Partially supported by the Association of Applied Sport Psychology grant program*

The relationship between commitment, expectancies for success, and task value in competitive gymnastics
Weiss, Windee M., University of Northern Iowa

The sport commitment model (e.g., Scanlan et al., 1993) and Eccles" expectancy-value model (e.g., Eccles, 1983) both suggest that an individual's motivation and behaviors in sport is related to perceptions of the sport context (e.g., social support and constraints, socializers' beliefs and behaviors), and their own psychological beliefs about sport (e.g., importance and value of sport, perceived costs, benefits, commitment). The purpose of this study was to explore the relationship between sport commitment constructs, expectancies of success, and subjective task value within a competitive youth context. Competitive female gymnasts (N = 490; ages 8-18 years of age, M = 11.22, SD = 2.27) completed measures designed to tap predictors of psychological commitment, sport commitment, expectancies of success, and subjective task value (i.e., perceived costs, importance, and utility value). A multivariate correlational design was employed to examine the relationships between sport commitment constructs, expectancies for success, and task value. The multivariate multiple regression analysis was significant: Wilks' lambda = .38, F (36, 1748) = 14.44, p < .0001. Two significant discriminant correlations emerged (Rc = .71 and .45, respectively). For the first discriminant function, results indicated that higher perceptions of attractive alternatives and lower perceptions of enjoyment, commitment, benefits, investments, and best friend social constraints was related to lower expectancies of success, perceived importance, and utility value, and higher perceived costs. The second discriminant function indicated that higher perceptions of benefits and lower perceptions of attractive alternatives, investments, and social constraints from coaches, parents, and best friends was associated with lower expectancies of success, importance, and costs. Additionally, the multivariate relationship between constructs changed when gymnasts' perceptions were analyzed based on competitive level.—*Partially supported by the Association of Applied Sport Psychology grant program*

Neural efficiency of elite curlers' brains during imagery training of strategy-based decision making
Westlund Stewart, Nicole, Western University; Mekers, William F., Laurentian University

The "neural efficiency" hypothesis suggests that expert performers exhibit lower levels of brain activation than novices when performing the same task (Haier et al., 1992). Evidence for the neural efficiency hypothesis has been found in a variety of sports including: archery, fencing, golf, gymnastics, karate, and marksmen. In these studies, elite athletes showed increased alpha power activity, indicating greater attentional focus. The purpose of this study was to test the neural efficiency hypothesis in elite and novice curlers using electroencephalographic (EEG) technology during strategy- based decision making and imagery training. It was hypothesized that elite curlers would exhibit better strategy performance than novices and exhibit greater alpha power during strategy-based decision making and imagery training. Following four weeks of imagery training, elite curlers would maintain this difference while novice curlers would show improvements in strategy performance and increases in alpha power. Elite (n = 6) and novice (n = 6) curlers participated in two laboratory sessions spaced four weeks apart, and engaged in strategy-based imagery training between the two laboratory sessions. Results showed that experts performed significantly better than novices on the strategy assessment overall, with their performance primarily mediated by increased low frequency power in the left frontal lobe. Elite and novice athletes who rehearsed the imagery scripts more than four times a week showed the greatest improvements on the strategy assessment from session 1 to session 2. Within this category, expert curlers reduced the amount of additional cortical processing to perform the strategy task. The frequency of imagery rehearsal affected the ability of novices to utilize working memory to complete the strategy assessment more quickly, with a greater level of activation in the left temporal lobe. These results lend support for the use of imagery training in the development and refinement of strategic abilities for both experts and novices in curling.

Why athletes use cognitive general imagery in curling: A qualitative investigation
Westlund Stewart, Nicole, Kouali, Despina, Hall, Craig R., Western University

Imagery is used for a variety of functions in sport: cognitive general (CG; imagery of strategies), cognitive specific (CS; imagery of skills), motivational general-arousal (MG-A; images related to arousal and affect), motivational general-mastery (MG-M; images related to confidence and focus), and motivational specific (MS; goal-related images; Hall et al., 1998). While many researchers have investigated the effects of these imagery functions on sport performance (Martin et al., 1999), only a small number of imagery interventions have examined the effects of CG imagery, yielding mixed results (e.g., Guillot et al., 2009; Munroe-Chandler et al., 2005). To address the lack of consistency in the research findings, a qualitative methodology was undertaken to better understand how CG imagery is used by athletes in a specific sporting context. Three focus groups were conducted to determine why skips use CG imagery in curling, as well as where and when this CG imagery use was taking place. Fourteen skips (Mage = 57.57, SD = 19.94) from both competitive and recreational levels participated in semi-structured interviews that were based on Munroe and colleagues' (2000) four Ws of imagery use. The skips had a wide range of experience playing the position, ranging from 1-50 years (M = 16.86, SD = 15.30). Results showed that skips used CG imagery to serve both cognitive (CG) and motivational (MG-A and MG-M) functions during competition, practice, and while spectating. CG imagery was used most often during competition to execute and plan strategies, as well as predict opponents' strategy and teammates' shots. In terms of motivational functions, CG imagery was used by some skips before and after competition to moderate emotions, and during competition to increase confidence and focus. These findings can help inform ways that researchers and sport psychology consultants can use CG imagery beyond its traditional strategy-based functions to help improve curling performance and provide guidance on how to best structure future imagery interventions.

Cognitive focus within road cycling time-trial performance using Think Aloud

Whitehead, Amy, Liverpool John Moores University; Polman, Remco C.J., Bournemouth University; Dowling, Christopher, Morley, David, Liverpool John Moores University

To measure the cognitions of time trial cyclists over the duration of a 10 mile real life competitive time trial using Think Aloud protocol analysis. Participants were 15 male and 3 female cyclists from a club in the North of England (M age = 40.9 years, SD = 11.5 years, M years' experience = 11.2 years, SD = 12.9 years). Participants wore iVue Horizon camera glasses, recording their verbalisations. Prior to the event cyclists were given a series of exercises and instructed to verbalise anything they were thinking throughout the event (Level 2). Each cyclist's time trial was analysed in four separate stages (0-2.5 miles, 2.5-5miles, 5-7.5miles, and 7.5-10miles) to identify thought processes across different times and distances. Data was transcribed verbatim and analysed using content analysis and grouped into themes. Themes consisted of (i) dissociative thoughts (unrelated to the task), (ii) external thoughts (distance, time, behaviours of others, speed, heart rate and environment), (iii) associative thoughts (pacing and fatigue), (iv) negative verbalisations, (v) positive verbalisations, (vi) technical, (vii) motivational and (viii) planning. Participants were interviewed for social validation purposes and asked their opinion of thinking aloud during performance. During stage 1, participant's thoughts centred on fatigue, pacing thoughts, their environment and technical elements of performance. However, throughout each stage of the event cognitive focus fluctuated. Themes identified in stage 1 decreased over time. In the final stage of the event participant's verbalisations centred on distance, time, behaviour of others, heart rate, negativity and motivation. 78% of participants reported that thinking aloud had positive or no effect on their performance and they would be happy to engage again. Allowing investigation of cognitive processes with endurance athletes that has the potential to supports sport psychologists, athletes and coaches in developing more detailed performance enhancing interventions for these athletes.

How the UK population are using technology to engage in Sport and/or Physical Activity.

Whitehead, Amy E., Morley, David D.M., Reeves, Matthew J., Ryrie, Gus, Liverpool John Moores University; Quayle, Laura R., Liverpool John Moores Univeristy

To investigate how the UK population use technology to facilitate and enhance their engagement in sport and/or physical activity. Design: An online survey was designed, incorporating the Transtheoretical Model of Behaviour change (TTM), to identify key factors that influence how and why an individual may use technology within their sport or physical activity engagement. 490 surveys were completed by participants (n=243 male, 235 female, 12 non-disclosed) aged between 16 and 65 years. The survey focussed on what stage participants were at within the TTM, whether technology was used to facilitate this behaviour, and how they used technology in their sport and/or

physical activity engagement. These questions were then linked to participants' motivations for using technology and reported using descriptive statistics. 301 participants (61%) were identified in the maintenance stage of the TTM as they indicated that they used technology to support their engagement in sport and/or physical activity; they had done so for over six months, and intended to do so for the foreseeable future. GPS enabled devices, downloaded applications and wearable technologies were most frequently adopted and used at least four times per week by over half of the participants (55%). Individual sports (running, cycling and athletics) were the most commonly reported for adoption of these technologies. Motivating users, collecting performance data and improving fitness were the main reasons stated by participants for using technology. To our knowledge, this is the first study of its kind in the UK that highlights the prevalence and behavioural influences of technology used by participants engaging in sport and/or physical activity. This provides crucial user preference data for policy makers, sports coaches and physical activity leaders in understanding the role of technology in future strategy and delivery development.—*Sports Coach UK*

Participant perceptions of physical activity-enhancing interventions for adults with disability: A meta-synthesis of qualitative research

Williams, Toni L., Leeds Beckett University; Ma, Jasmin K., Martin Ginis, Kathleen A., McMaster University

The United Nations Convention on the Rights of Persons with Disabilities enshrines the rights of disabled people to access services in all areas of citizenship including participation in recreational, leisure and sport activities. Despite this protection, people with disabilities face multiple personal, environmental and social barriers to participation in physical activity (PA). As a result, disabled people are more likely to be inactive compared to the able-bodied population and are at a greater risk of inactivity-related diseases. Thus, there is an urgent need for behavior change interventions to increase PA by specifically addressing the situations of people with disabilities and their barriers to participation. This original meta-synthesis of qualitative research was undertaken to explore the participants' perceptions of PA-enhancing interventions for adults with physical disability. To identify published articles relevant to the meta-synthesis, a rigorous systematic search of electronic databases and hand search of relevant journals was undertaken. In total, 76 papers were read in full, and based on the inclusion criteria, 10 papers were included for review. Following a critical appraisal of the papers, methods of thematic synthesis were drawn upon to generate analytical themes through interpretation and conceptual synthesis. Seven interrelated analytical themes were constructed representing both components and outcomes of the interventions. These were: 1) social support; 2) diversity; 3) communication; 4) behavioral strategies; 5) changing thoughts; 6) knowledge; 7) health and well-being. The results of this meta-synthesis provide significant new information that will help interventionists design more effective PA-enhancing interventions, and researchers to better identify and measure key mechanisms and outcomes associated with successful PA-enhancing interventions for people with disabilities.

Parental social control and changes in physical activity of preschool-aged children: A diary study

Wilson, Kathleen S., California State University, Fullerton

Most preschool-aged children are currently not active enough for health benefits (Tucker, 2008). As such, parents play a key role in promoting physical activity (PA) for their preschool aged children (Loprinzi & Trost, 2010). One way that parents may influence their child's activity is through the use of social control, which is regulatory influence where the parent attempts to prompt or persuade their child to become more active (Wilson & Spink, 2010). Low activity levels might lead a parent to exert social control that would then lead to an increase in PA. However, detecting such changes using traditional survey methods may a challenge. A diary methodology that examines parent-child influences on a day to day basis may be more likely to detect these changes. The purpose of this study was to use a daily dairy to compare PA levels before and after a social control attempt by parents. Parents and child dyads (N=13) participated in a daily diary study for 10 days. Children wore an accelerometer for the duration of the study. Each evening parents completed a questionnaire about their interactions with their children including the time of any social control attempts. Using the accelerometer data from the child, the 30 minutes prior to this time was identified as the pre- PA and the 30 minutes following this time was identified as the post-PA. Analyses were performed using multilevel modelling with pre/post, nested within attempts and nested within individuals. The outcome of the model was PA and the independent variable was time (pre or post). For the prediction of all PA, time had a significant effect (b=2.5, p=.04), which meant that 2.5 more minutes were spent

being active during the half hour following the attempt than the half hour preceding the attempt. This accounted for 2.1% of the variance in PA. For moderate and vigorous PA, time had no significant effect on activity (b=0.1, p=.80). These findings suggest that parents' attempts to promote PA in their children appeared to have a short term effect that was mostly at the light intensity level.—*California State University, Fullerton Junior Faculty Research Grant*

The mediating moral effect of moral disengagement on the association of obsessive passion and attitudes toward PEDs for competitive collegiate athletes

Wilson, Wade, Drewery, David, University of Waterloo

Use of performance enhancing drugs (PEDs) can have negative consequences for competitive athletes (e.g., Buckman, Faris, & Yusko, 2013). There is a strong connection between attitudes towards PEDs and drug use (Laure, Lecerf, Friser, & Binsinger, 2004; Wanjek, Rosendahl, Strauss, & Gabriel, 2007). Scholars have called for research that examines the conditions under which athletes develop favourable attitudes towards PEDs (Petr"czi & Aidman, 2008). Building off of earlier research (e.g., Boardley & Kavussanu, 2011; Coakley & Donnelly, 2009; Lucidi et al., 2008), and using Canadian collegiate sport as a context, this study examines the potential role of athletes' sport identity and moral disengagement in the development of favourable attitudes towards PEDs. A survey was administered to competitive (varsity and high-level recreation) athletes (n = 587) participating in one of seven team sports at four Canadian universities. The survey contained a battery of validated psychological inventories and a brief demographic questionnaire. Data were analyzed using a multi-group structural equation modelling approach in AMOS. Results indicate that the way competitive athletes' identity is either affirmed or expressed through participation influences their attitudes towards PEDs. Moral disengagement may also partially mediate these influences, and differences are evident between varsity and high-level recreational athletes. This study demonstrates that intercollegiate athletes' identity plays a significant role in the development of attitudes towards PEDs, and also confirms the role of moral disengagement in this development. Practitioners should consider interventions targeting athletes' identities to reduce favourable attitudes towards PEDs. Athletes can also educate themselves about the potential downside of over-conformity with competitive sport norms. Future research should consider replicating these results in other contexts while including other salient factors and while considering longitudinal and behaviour-based methodologies

Exercising to increase ownership of one's health and live better after breast cancer

Wing, Erin K., Saunders, Stephanie, University of Ottawa; Burke, Shaunna, University of Leeds; Woodard, Stephanie, Ottawa Regional Cancer Foundation; Brunet, Jennifer, University of Ottawa

Group-based exercise programs developed for breast cancer survivors (BCS) typically aim to enhance BCS' health and promote more active participation of women in their own personal healthcare. This presentation describes the results of a qualitative study we conducted to explore how participation in an 8-week group-based exercise program impacted BCS. The program consisted of weekly exercise sessions where a group of BCS engaged in a combination of endurance and strength exercises together. The program was led by a specially trained instructor who modeled each exercise, along with possible variations to accommodate women whose physical limitations might otherwise hinder their ability to perform the exercise. We conducted three interviews with 13 BCS (Mage = 60.6 years) who participated in the program, namely once during the course of the program (1-4 weeks after the first session) and twice after the program (immediately after and 2 months after the last session). Interviews were transcribed verbatim and data were analyzed deductively and inductively using thematic analysis. We observed that BCS experienced post-traumatic growth during and after the program, as supported by themes that emphasized appreciation of life, relating to others, personal strength, and new opportunities. Many times, these themes were connected to related themes of personal health care beliefs, knowledge and confidence to take action, taking action for one's health, and implementing strategies to maintain health behaviors, which are characteristics of patient activation. Our findings provide empirical evidence that group-based exercise programs appear to have a number of benefits, they may promote positive changes in various dimensions of post-traumatic growth and empower BCS to become advocates for their health. BCS should be encouraged to participate in group-based exercise programs.

Perceptions matter more than observations: Different operationalizations of team unity and their relationship to individual and team outcomes

Wolf, Svenja A., Feddes, Allard R., University of Amsterdam

A crucial feature of any sport or exercise group is its unity. Without a minimal amount of unity no group could exist and unity, in the form of cohesion, has been linked to numerous adaptive outcomes. Nonetheless, a topic of discussion remains how cohesion is best operationalized. Analyzing responses from 815 athletes from 61 competitive sport teams, we tested (1) if athletes' perceptions of team cohesion (scores on the Group Environment Questionnaire, GEQ; Carron et al., 1985) were congruent with observed team unity (individual deviation from and team-variability around team-mean GEQ-scores) and (2) which operationalization of team unity in terms of content (social vs. task GEQ- dimensions), focus (individual team attraction vs. group integration GEQ- dimensions), level (individual vs. team-mean GEQ-scores), and objectivity (see 1) best predicted team-performance, athlete-motivation, and athlete-emotion. Results of OLS and REML regression analyses supported our expectations that (1.1) athletes' perceptions of individual team attraction predicted their statistically observed individual deviation from the team-mean (β = -.09 to -.34), and (1.2) perceptions of social group integration predicted team- variability around the mean (β = -.12 to -.36). Further, as expected, (2.1) both individual team attraction and group integration emerged as predictors of all outcomes (β = |.09| to |.46|). Conversely, counter to our expectations, (2.2) outcome-prediction was not best if the remaining operationalization of team unity matched that of the DV. Instead, we found both social and task contents as well as individual and team levels to predict all outcomes and perceptions generally to predict outcomes better than observations (β = |.12| to |.46| vs. β = |.09| to |.20|). We conclude that athletes' subjective perceptions of team unity are fairly accurate reflections of teams' behavioral unity and, in its facets, seem to be more strongly related to outcomes. This finding supports current subjective, multidimensional approaches to team unity and cohesion measurement.—*German Academic Exchange Service; German Sport University Cologne*

A Single Bout of Aerobic Exercise Benefits the Attentional Blink

Wu, Chien-Ting, Foli, Elvis M., Nichols, Ashley M., Nair, Pratik, University of South Carolina Upstate; Hillman, Charles H., University of Illinois at Urbana-Champaign

A growing body of acute exercise research has demonstrated the selective beneficial effects on cognitive control following exercise. However, our knowledge base regarding other areas of cognition remains limited. Specifically, no prior research has investigated the effect of acute exercise on the temporal dynamics of visual attention. Therefore, the purpose of the current study aimed to examine the effect of acute exercise on temporal attention. A within-subjects design included 31 young adults to assess exercise-induced changes in performance during an attentional blink (AB) paradigm. On day 1, a VO2 max test was administrated to all participants to measure cardiorespiratory fitness. On subsequent days, task performance was collected while participants complete an AB task before (i.e., baseline) and after an intervention consisting of 20 minutes of either treadmill walking/running (60-70% of maximal heart rate) or a seated rest control. Analysis of AB task performance (i.e., T1|T2 response accuracy) was performed using a 2 (time: pretest, posttest) x 2 (condition: exercise, rest) x 8 (lag: lag1, lag2, lag3, lag4, lag5, lag6, lag7, lag8) repeated measures model. Results indicated that relative to task conditions within the attentional blink windows (i.e., Lag3, Lag4, and Lag5), the exercise condition exhibited improvements in T1|T2 accuracy from pretest to posttest, ps $\leq$ .004, while no such effect was observed for the rest condition, ps $\geq$ .62. These findings indicated that single, acute bouts of moderately-intense aerobic exercise may improve temporal attention, and further support the use of moderate acute exercise as a contributing factor for increasing attention.

Effects of acute aerobic and resistance exercises on the shifting aspect of executive function: An ERP study
Wu, Chih-Han, Wang, Chun-Chih, Chang, Yu-Kai, National Taiwan Sport University

Recently, studies that have explored the relationship between exercise and cognitive functions have developed rapidly. Previous studies have shown the beneficial effects of acute exercise on cognition; however, a majority of these studies that have employed mainly aerobic exercise and other type of exercise modalities, such as resistance exercise, remain understudied. The purpose of this study was to explore the relationship between acute aerobic and resistance exercises on the shifting aspect of executive function. Additionally, the acute exercise associated with potential neuroelectric response, as assessed by event-related potential, was also examined. Thirty-five young male adults were recruited and randomly assigned into aerobic exercise, resistance exercise, and control conditions, with a counterbalanced order. Cognitive performance was measured via a task switching paradigm and assessed following each of the three conditions. The results revealed that the participants that performed the two types of exercise conditions exhibited shorter reaction times in the global switch of the homogeneous and heterogeneous, and in the local switch of the non-switch and switch, than those in the control conditions. Moreover, larger P3 amplitudes in both exercise conditions, compared to the control conditions, were also observed, wherein the non- significance between the two exercise modalities was found. The results of this study were consistent with those of previous studies employed aerobic exercise and further established the association between acute aerobic and resistance exercises on executive function and neuroelectric activity. Further research on the relationship between the different exercise modalities is suggested to further examine the role of moderating factors, such as age, fitness, and types of cognitive functions.

Are barriers always a limiting factor to participation in physical activity?
Wurz, Amanda, Brunet, Jennifer, University of Ottawa; Karvinen, Kristina, Nipissing University

Among cancer survivors, physical activity (PA) can help to control many of the distressing effects of the disease and its treatment. Despite this, many cancer survivors are inactive or insufficiently active. Perceived PA barriers may adversely influence cancer survivors' participation in PA. However, drawing on Bandura's social cognitive theory, cancer survivors' beliefs about their ability to overcome barriers (i.e., barrier self-efficacy) may attenuate the influence of perceived PA barriers on participation in PA through a moderation effect. In this study, we aimed to describe the relationship between perceived PA barriers and PA behavior, and test if barrier self-efficacy moderated this relationship. Cancer survivors (N=83; Mage=49.95 years; SD=14.48) completed a questionnaire online. Analysis involved hierarchical linear regression analysis. We found that, after adjustment for age, sex, and body mass index, perceived PA barriers, barrier self-efficacy, and the interaction between these two variables accounted for an additional 23% of the variance in PA behavior. Perceived PA barriers (β=-.28, p=.01) and barrier self-efficacy (β=.33, p=.004) were significantly associated with PA behavior. The interaction between perceived PA barriers and barrier self-efficacy was not significant (β=-.06, p=.52). Our results add to the evidence that PA barriers and barrier self-efficacy are determinants of participation in PA. Seemingly, this suggests that interventions strengthening cancer survivors' ability to overcome PA barriers may be important to promote participation in PA. Further, our finding that barrier self-efficacy did not buffer the influence of perceived PA barriers on participation in PA may relate to type of self-efficacy we assessed. It is possible that cancer survivors must engage in many regulatory behaviors to be physically active. Thus, exploring other types of self-efficacy beliefs may offer an interesting area for future inquiry.

Spatial working memory response to acute exercise at different time points in middle-aged adults
Yang, Wen-Chung, Huang, I-Lun, Chang, Yu-Kai, National Taiwan Sport University

Cognitive functions reach their peak performance and begin declining at 20 years of age. The past researches have evidenced the facilitative effects of acute exercise on cognitive functions among children, young, and older adults; nevertheless, the relationship between acute exercise and cognition among the population between middle aged adults is still unclear. Additionally, the time point of when the cognitive test is assessed might moderate the effects of acute exercise on cognition. The purpose of this study was to examine the spatial working memory response to acute exercise at different time points in middle-aged adults. Thirty-four community- dwelling adults, aged between 30 to 40 years old, were recruited. All participants were randomly assigned into exercise or control groups. The

participants in the exercise group were required to perform exercise for 30 minutes, including a warm-up for 5 minutes, followed by moderate intensity exercise for 20 minutes, and a cool- down for 5 minutes, whereas the participants in the control group were required to sit quietly on a chair and read books for 30 minutes. The participants' spatial working memories were assessed at four time points as baseline: immediately after intervention, 30 minutes after intervention, and 60 minutes after intervention. The results revealed that the acute exercise group had the shorter response time, compared to the control group, at immediately after the exercise, 30 minutes after the exercise, and 60 minutes after the exercise, wherein no significant difference in their accuracy rates were observed. The findings suggested that the acute exercise will improve spatial working memory at immediately after acute exercise, and sustain this acute exercise effect for up to 60 minutes in the population. A further understanding of the effects of acute exercise on cognition at different time points is suggested to be extended by examining other aspects of cognition and populations with different levels of cardiovascular fitness.

The role of enjoyment and burnout on basketball players positive youth development

Yapar, Ahmet, Middle East Technical University, Faculty of Education, Physical Education and Sport Department; Ince, Mustafa Levent ., Midde East Technical University

Studies point out to link between sport programs and positive youth development, enjoyment and also burnout.The purpose is to investigate the role of enjoyment and burnout on basketball players' positive youth development. At total of 390 male basketball players from Turkey with mean age of 12.9"0.7 participated in the study. Participants completed Youth Experiences Survey in Sport (YES-S), Sources of Enjoyment in Sport Questionnaire and (SEYSQ) and Athlete Burnout Questionnaire (ABQ).Stepwise regression analysis was used to examine the relationship between subscales of SEYSQ (Self Referenced Competency, Competitive Excitement, Effort Expenditure, Other Referenced Competency and Recognition, Affiliation with Peer and Positive Parental Involvement) and subscales of ABQ (Emotional and Physical Exhaustion, Reduced Sense of Accomplishment and Devaluation) subscales of YES-S (Personal and Social Skills, Cognitive Skill, Goal Setting, Initiative and Negative Experiences) Results demonstrated that YES-S Personal and Social Skills subscale was significantly predicted by SEYSQ Effort Expenditure, Competitive Excitement and Affiliation with Peers subscales ($F(1,388)= 425.15$, $p<.001$)) with an R2 of 61.4. YES-S Cognitive Skills subscale was predicted by SEYSQ Positive Parental Involvement and Competitive Excitement subscales ($F(1,388)= 186.29$, $p<.001$) with an R2 of 48.8. YES-S Goal Setting subscale was predicted by SEYSQ Effort Expenditure and Competitive Excitement subscales ($F(1,388)= 87.92$, $p<.001$) with an R2 of 30.9. YES-S Initiative subscale was predicted by SEYSQ Positive Parental Involvement and Affiliation with Peers subscales ($F (1,388)= 32.42$, $p<.001$) with an R2 of 13.9. However YES-S Negative Experiences subscale was predicted by both SEYSQ Effort Expenditure and ABQ Reduced Sense of Accomplishment and Emotional and Physical Exhaustion subscales ($F(1,388)= 132.08$, $p<.001$) with an R2 of 50.3. Findings indicated that positive subscales of YES-S were highly explained by SEYSQ subscales. However, negative subscale of YES-S were linked to both SEYSQ and ABQ.—*The Scientific and Technological Research Council of Turkey*

The dose-response relationship between duration and executive function in middle-late-aged adults: A preliminary Study

Yu-chen, Hsieh, Feng-Tzu, Chen, Yu-Kai, Chang, National Taiwan Sport University, Taiwan

Exercise not only facilitates physical health and reduces the risks of disease, but also has a positive impact on mental health, such as cognitive functions. Previous studies have generally reported an inversed-U trend between intensity of acute exercise and cognition, showing that moderate intensity exercise has a larger positive effect on cognitive performance. Regarding duration, however, only one current research has examined the difference among 20 minutes, 30 minutes, and 55 minutes of exercise in younger adults, where an inverted-U shape between exercise and Stroop Test performance was also observed. The present study attempts to further the previous study's findings by exploring the dose-response relationship between the duration and the cognitive function in middle-old-age adults. Twenty healthy adults, aged 55-65 years old, without cardio- and neuro-related diseases, were recruited. All participants were experienced to four treatments using within-subjects design, including a control treatment, and exercise treatments for 20, 30, and 55 minutes (5 min for warm up, 5 min for cool down were included). Three exercise treatments consisted of 5 min for warm up, 5 min for cool down, and cycling on the ergometer at moderate intensity for 10, 20, and 45 minutes, wherein the control treatment was reading for 30 minutes. A Stroop task was

assessed after each treatment was completed. The results revealed acute exercise for 30 minutes has a significantly shorter reaction time for both congruent and neutral conditions of the Stroop task, as compared with the control treatment. However, no differences were found in the incongruent condition for each of the designed treatments. The results suggest that acute exercise done at moderate intensity for 30 minutes has positive effects on basic information process efficiency, while the other treatments may not find similar benefits, providing the initial foundation for establishing exercise prescriptions regarding cognitive function for the population.

Effects of cognitive control exertion on feeling states and performance of a graded exercise test

Zering, Jennifer C., Graham, Jeffrey D., Langvee, Jason H., Bray, Steven R., McMaster University

Exerting cognitive self-control leads to subsequent decrements in muscular and cardiovascular endurance performance (Bray et al., 2008; Marcora, 2009). According to the Process Model of self-control (Saunders & Inzlicht, 2015), affective feeling states may account for later self-control impairments. Affective feeling states are sensitive to exercise and show a pronounced negative shift in valence at the ventilatory threshold (VT) (Ekkekakis et al., 2011). The purpose of this study was to investigate feeling states in response to a challenging cognitive control task (stop-signal task; SST) followed by a graded exercise task to exhaustion (GXT). Recreationally active participants (N = 20; Mage = 20.25) completed two testing sessions separated by one week. Sessions were counterbalanced, with either a control (SST-C) or experimental (SST-E) task performed prior to each GXT. Feeling states were measured using the Feeling Scale (FS) and Felt Arousal Scale (FAS) throughout both tasks. Time to exhaustion on the GXT was significantly shorter following the SST-E than the SST-C ($p < .05$; $d = .49$). Repeated measures MANOVA showed similar within-task changes in FS in both conditions, but no significant differences between conditions during the SST tasks; however, FAS scores were significantly higher during the SST-E compared to the SST-C ($p < .01$). There were no significant differences in feeling states prior to, or upon completion of, the GXTs. However, FS was significantly less positive at iso-time corresponding to predicted VT in the SST-E condition ($p < .05$). Results show feeling states during exercise are altered by prior cognitive control exertion. Decreases in positive valence in concert with increased activation may prime a negative shift in affect as exercise becomes more strenuous and thereby reduce self-control (exercise tolerance), as predicted by the Process Model. Alternatively, shifts in affect may reflect responses to physiological manifestations of fatigue that carry over from cognitive to physical tasks and become salient at moderate exercise intensities.—*SSHRC*

Improving adolescent self-efficacy, calibration, and health-related fitness knowledge through physical education

Zhu, Xihe, Haegele, Justin A., Old Dominion University

Self-efficacy, one's confidence in successfully performing a specific task, and calibration, the accuracy of one's predicted performance compared to their actual performance, are important factors for metacognitive processes and self-regulation. This paper reports an intervention effort to improve adolescent students' calibration, self-efficacy, and health-related fitness (HRF) knowledge through concept-based physical education lessons. Prior to the lessons, participants (N=90, seventh graders) took a 15 item HRF knowledge pretest, predicted their HRF knowledge test score, and completed a self- efficacy scale. After ten lessons, participants took a posttest on the same measures. We conducted descriptive statistical analyses on self-efficacy, predicted score, actual score, and computed calibration accuracy (Hacker et al., 2013). Paired sample t-tests were then conducted to detect the difference between the pre and posttest measures. Lastly, Pearson product-moment correlation analyses were conducted to examine the association between the variables. Participants significantly over-predicted performance in the pretest ($t=-3.09$, $p<.01$, $d=.45$), but slightly under- predicted posttest scores ($t=.69$, $p>.05$). They significantly improved their self-efficacy ($t=-3.68$, $p<.01$, $d=.37$), calibration ($t=-3.49$, $p<.01$, $d=.49$), and HRF knowledge ($t=9.01$, $p<.01$, $d=.99$) from pre to posttest. Predicted scores moderately correlated with self-efficacy ($r=.45\sim.72$), but marginally correlated with actual scores and calibration ($r<.26$). The findings suggest that concept-based lessons are effective in improving adolescent self-efficacy, calibration, and HRF knowledge. The improved calibration increased the correlation coefficient between self- efficacy and posttest score. Still, the participants demonstrated lower calibration than those found in other academic disciplines (e.g., mathematics). Longer-term interventions or exposure to concept-based lessons will likely further enhance adolescent efficacy, calibration, and HRF knowledge.