Journal of Sport & Exercise Psychology, 2012, 34(Suppl.), S1-S4

Keynote Speakers

Keynote Speaker: Sport and Exercise Psychology

Chaos, reactance, and epiphany: The role of nonlinear motivation in physical activity

Ken Resnicow, University of Michigan

The understanding and modification of health behavior, including physical activity, has been guided by a cognitive, rationale paradigm. Within this paradigm, change is conceptualized as a linear, deterministic process. However, the conceptual and statistical assumptions underlying this cognitive, linear paradigm may be seriously flawed, and might limit our ability to explain and change health behavior. In particular, such a perspective fails to account for nonlinear, chaotic, and quantum influences on human thought and action. We propose that health behavior change, including diet and activity, is better understood through the lens of chaos theory and principles of self-determination theory. Key principles from these perspectives are as follows. (1) Behavior change is often a quantum rather than linear event. (2) Behavior change is a chaotic process that is highly variable and difficult to predict. (3) Motivation is influenced by nonrational processes. (4) Behavior change is a complex dynamic system that involves multiple component parts that interact in a nonlinear fashion and the results of their interaction are often greater than the sum of their parts. (5) Behavior change is sensitive to initial conditions. (6) Unsolicited advice elicits resistance. This presentation will address how these principles can be incorporated into the development and evaluation of diet and activity programs. Implications for future research will also be presented.

Keynote Speaker: Human Kinetics Lecture

The Body in Mind, But Whence the Mind?

Lawrence Shapiro, University of Wisconsin

Psychologists have grown increasingly aware of the body's role in cognition. So-called embodied cognition seeks to distinguish itself from more traditional cognitive science through its emphasis on the body's capacity to play the information-processing roles that once were attributed to computational processes. In this talk I will highlight some respects in which our bodies do work once credited to symbolic, algorithmic processes. But the theoretical commitments of this approach to cognition suggest some surprising results regarding where cognition and minds might be located. Are minds always in the head? Might groups have minds? I'll explore these as well as other interesting philosophical issues that emerge from the embodied cognition perspective.

Keynote Speaker: Developmental Perspectives—Motor Control/Coordination/Rehabilitation

How does locomotor experience produce psychological reorganizations?

Joseph Campos, University of California, Berkeley

Typically, when a single factor is linked with a wide number of changes in psychological function, behavioral scientists infer a single cause or process that underlies the coherence observed among outcomes. Locomotor experience is a case wherein that principle does not operate. Upon acquiring locomotion (either through endogenous means or through "artificial" experiences such as the provision of walker devices), infants undergo changes in emotion, perception, cognition, and social development, including attachment. To speak metaphorically, locomotor experience is like the trunk of a tree, each branch of which (i.e., each form of experience springing from locomotion) affects one outcome, whereas another branch (or different form of experience related to locomotion) accounts for another outcome. In this presentation, the various forms of outcomes of locomotor experience will be reviewed, and then the experience recruited by locomotion will be described. Finally, the separateness of the outcomes will be documented. Special emphasis will be given to the processes that give rise to fear of heights, on the one hand, and joint visual attention, on the other.

Keynote Speaker: Motor Learning and Control

The sporting brain, or learning for sport, learning for life, learning *throughout* life

Vincent Walsh, University College London

The brain accomplishes many impressive tasks of which we are sometimes proud: memory, language, chess, mathematics, music, and art. The brain receives less credit for its sporting achievements despite the fact that sport is arguably the most complex and demanding of its achievements. Sport demands planning, motor skill, emotion, social interaction, risk assessment, memory, body awareness, awareness of others, strategic knowledge, variable feedback, consequences, and unique stresses. It is little wonder that classical laboratory theories of motor skill and the simple tasks that are used have limited translational potential for sport. I will discuss some of the critical limits of laboratory science for sporting and other real-world applications and propose some ways in which we can begin to overcome these limits. The importance of different types of brain plasticity and the value of down time to allow consolidation of skills will also be discussed. Finally, I will show why sport and exercise are valuable, possible, and in my view necessary, for cognitive well-being in later life.

Senior Lecturers

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Translating pediatric disability and motor intervention research to produce more physically active infants

Dale Ulrich, University of Michigan

I will summarize multiple research projects I have been involved in over the past 20 years related to early motor interventions. These intervention studies involve infants with Down syndrome and infants at risk for a diagnosis of cerebral palsy in an effort to enhance experienced-induced brain plasticity and reduce the significant delay in learning to walk. These studies involve the use of newborn stepping, conjugate reinforced supine kicking, and body weight supported treadmill stepping. The prevalence of early onset of obesity during infancy is increasing. Being born large or small for gestational age and rapid weight gain during the first six months of life are major risk factors. Public health interventions implemented during the first 24 months of life use parent education and nutrition as the sole elements of the intervention. No interventions have employed physical activity and enhanced movement experience during infancy. This suggests that energy intake is the only part of the energy equation that should be modified. I will propose a physical activity intervention program from one month to 12 months of age in an effort to produce a more physically active infant, promote early locomotor development, increase movement experience, and reduce rapid weight gain in infants at risk for obesity.

Sport and Exercise Psychology

Takin' it to the streets: A community-university partnership approach to physical activity research and knowledge translation

Kathleen A. Martin Ginis, McMaster University

Over the past decade, researchers have faced increasing pressure to bridge the gap between the generation of new knowledge and the translation of that knowledge into applications and products that can benefit society. Attempts to address these demands can lead to a variety of new challenges and opportunities for physical activity researchers. *SCI Action Canada* (www.sciactioncanada.ca) is an example of a community-university partnership approach to bridging the research generation—knowledge translation gap. It is an alliance of 30 community-based organizations and university-based researchers working together to increase physical activity participation among people living with a spinal cord injury (SCI). The alliance is underpinned by a commitment to use scientific rigor to develop and test physical activity-enhancing resources and interventions, and to translate these innovations into products and services for implementation within the SCI community (i.e., people living with SCI, health care professionals, service providers). Some examples of SCI Action Canada's research and knowledge translation activities include: development and the international launch of evidence-based physical activity guidelines for people with SCI; development and the national launch of an evidence-based, SCI-specific physical activity Toolkit; translation of two randomized controlled trials into a nation-wide, telephone-based

physical activity counseling service for people with SCI; development and evaluation of evidence-based, print and video physical activity resources for persons with SCI. This presentation will provide an overview of activities undertaken by SCI Action Canada with an emphasis on key challenges and opportunities that have arisen. Recommendations will be presented regarding the use of the community-university partnership approach to develop, evaluate, and implement physical activity innovations.

Motor Learning and Control

The context of performance: Unified principles and diverse applications

Peter Hancock, University of Central Florida

"Man is the measure of all things" and as I am sure Protagoras would have conceded, women also. However, the heart this phrase emphasizes the human-centered nature of our collective history and experience. What I look to achieve in my presentation is an exploration of how these central principles of behavior, that we have collectively distilled and assembled, can be applied to human goals, aspirations, and performance writ large. I do this through an exploration of various areas of application. To accomplish this, I will feature my own autobiographical progress, which has sprung from my grounding in motor learning and control and then developed into an examination of human interaction with technical systems. In showing the indissoluble link between the foundational science of motor control and the technological mediation of human factors and ergonomics, I hope to inform and inspire others into a consideration of the greater aspirations for science in human existence. In terms of specifics, I shall discuss the work my laboratory has produced over a number of decades on driving, flight, and other human-augmenting technologies, with a special focus on performance under stress and high workload conditions. I shall communicate how these various interests were inspired by and contingent on the discussions and disputes that were, and still are, central to an understanding of the human motor system and how it achieves its necessary goals across the process of learning, maturation, skill development and the skilled exhibition of expertise. To conclude my tour, I shall look to dispense, discuss, and dispute, the proposition that science and morality (proximal understanding and ultimate meaning) can be dissociated and look to show why the foregoing principles and their ubiquitous application means that science in general bears a heavy, if unacknowledged burden in the sadness of our times. If you are with me to the end, I shall look to reward, via liberation and libation.

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Thursday, June 7

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Title: Life-span changes in the integration of posture with other goal-directed behaviors

Organizer: Jeffrey M. Haddad, Purdue University

Life-span changes in the integration of posture with other goal-directed behaviors—Symposium overview

Rhea, Christopher K., University of North Carolina at Greensboro

When performing typical daily tasks, the role of the postural system is more complex than merely maintaining an upright equilibrium. Rather, balance must be controlled in a manner that maintains upright posture while concurrent goal-directed tasks are performed. For example, when performing a precision-demanding task, young healthy adults minimize postural sway since extraneous movements could potentially reduce accuracy. However, when performing low precision tasks (e.g., reaching for a large object), extraneous postural movements are observed. Maintenance of a rigid posture could reduce the flexibility and adaptability of the postural system. Therefore, postural movements are coordinated with the manual movement, facilitating the performance of the task. It appears healthy young adults modify postural sway based on the constraints of a concurrently performed task. In this symposium, we discuss how the integration of posture with other goal-directed tasks changes through the life span. The first presentation will discuss the development of task-dependent postural control. Specifically, newly standing infants modulated the magnitude and complexity of postural sway as a function of a concurrent task, in a manner that facilitated task performance. The second presentation will discuss how the dynamic nature of most daily tasks requires rapid postural modulations in response to varying movement constraints. Using a variety of linear and non-linear measures, we discuss the nature of small time-scale postural modulations that occur when performing typical complex tasks. Finally, the third talk will discuss how age-related declines in task-dependent postural control may increase the risk of falls while performing routine daily activities (e.g., reaching for an item or walking around clutter) and the impact of balance training.

Life-span changes in the integration of posture with other goal-directed behaviors: Standing infants adapt postural sway when engaging in a visually demanding supra-postural task

Claxton, Laura J.; Strasser, Jennifer; Leung, Elise; Ryu, Joong Hyun; Purdue University

Surprisingly, newly standing infants can adapt their postural sway to facilitate completion of a supra-postural task. Infants will stand for three times their typical standing duration and exhibit more complex sway patterns when holding an interesting toy (Claxton et al.,

2011). The current study further explores how infants modulate their posture using a visually demanding supra-postural task similar to that used with adults (Stoffregen et al., 2000). Eleven 11-month-old infants (in the cruising stage) stood on a force plate and looked at no image (a blue screen), a large image of an animal (e.g., horse, duck), and a small image of an animal (1/2 the size of the large image) displayed on a computer monitor. Trials were intermixed and counterbalanced. Center of pressure data (CoP) (collected at 120 Hz) were synchronized with digital video. Statistical analyses were done using one-way repeated measures ANOVAs and follow-up paired sample *t* tests. Infants stood longer while viewing the small image (M = 6.7 s; SE = 1.5) as compared to the large image (M = 5.0 s; SE = 1.0) and no image (M = 3.6 s; SE = 0.7) ($p < 0.05$). Sway reduced in the AP direction when viewing the small image (M = 12.5 mm; SE = 0.7) as compared to the large image (M = 15.4 mm; SE = 1.0) and no image (M = 14.8 mm; SE = 1.0) ($p < 0.05$). Additional, the mean velocity of sway was marginally lower ($p = 0.08$) while viewing the small image (M = 115.7 mm/s; SE = 9.4) as compared to the large image (M = 129.6 mm/s; SE = 9.1). Sample Entropy (SampEn), a measure of sway complexity, was calculated from the net CoP trajectory. SampEn was higher while viewing the small image (M = 0.58, SE = 0.03) as compared to the large image (M = 0.42, SE = 0.05) ($p < 0.05$). Thus, as the visual demands of the task increased, infants stabilized and showed more complex sway patterns. These results provide evidence that infants adapt their postural sway in a manner similar to adults (e.g., Stoffregen et al., 2000) when performing a visually demanding task.

Life-span changes in the integration of posture with other goal-directed behaviors: The task-dependent modulation of posture in young adults

Haddad, Jeffrey M.; Rietdyk, Shirley; Ryu, Joong Hyun; Purdue University

In the postural control literature, there is ambiguity regarding what it means to be stable. Often, a reduction of postural sway is considered to be indicative of a stable posture. Alternatively, reduced postural sway could be a sign of a rigid and less adaptable system. A newer view is that optimal postural control requires the nervous system to modulate the magnitude and complexity of postural sway based on the constraints of a concurrent task. Building off this theoretical viewpoint, we first provide data demonstrating that young adults modulate postural sway over small time-scales when performing tasks with rapidly changing constraints. For example, when performing a precision fitting task (placing an object through an opening) postural movements were not constrained at the beginning of the movement when the accuracy demands of the task were low. Therefore, postural movements were allowed when they did not threaten upright stance and did not impede the performance of a concurrent task. However, as the object approached the opening, postural movements were quickly attenuated to enhance manual accuracy. In another typical daily task, load handling, we show that postural modulations do not occur equally in both lower limbs. In fact, there is an apparent trade-off between the limbs. When performing an asymmetrical load handling task, center of pressure complexity (measured using Sample entropy) decreased under the loaded limb, suggesting a more rigid leg posture was adopted to stabilize the added mass. However, the complexity in the unloaded limb increased, suggesting the unloaded limb adopted more adaptable postural dynamics to compensate for the loss of flexibility of the loaded limb. We conclude by discussing how this complex task-dependent postural control develops through childhood and into young adulthood.

Life-span changes in the integration of posture with other goal-directed behaviors: Balance training to improve the performance dual-task activities in older adults

Raffegeau, Tiphanie E.; Seaman, Jessica M.; Ryu, Joong Hyun; Muir, Brittney; Haddad, Jeffrey M.; Rietdyk, Shirley; Purdue University

In normal daily life, balance must be maintained while other concurrent tasks (such as reaching, walking, and even thinking) are performed. In other words, everyday life requires dual-task activities to be performed. In older individuals an impaired ability to dual-task may lead to an increased risk of falling (Faulkner, 2007). We examined if balance training would improve performance of a dual-task activity: standing while performing a precision manual movement. Eighteen older adults (avg = 81 years) balance trained on either a Biodex Balance System SD or a wobble board for six weeks, three times a week, 20 min per session. Nineteen age-matched subjects formed the control group. Although both training devices require stance to be maintained on an unstable surface, the Biodex provides real-time visual feedback regarding center of pressure location. During Biodex training, participants played balance games such as tracing their center of pressure trajectory around a maze. The wobble board group was required to shift their body in a similar manner to the Biodex group, but received no visual feedback. All participants performed a standing manual precision fitting-task before and after the six-week intervention. Postural time-to-contact (a measure of stability), and arm and trunk kinematics were calculated. The Biodex group and Wobble board group exhibited a 30% and 5% increase in time-to-contact and a 50% and 30% increase in trunk lean respectively. Slight decrements in both variables were observed in the control group. The added benefits of Biodex training may stem from the real time visual feedback, which improves the integration between visual and proprioceptive feedback. Interestingly, these improvements occurred even though subjects received no training on the manual task. Therefore, the single paradigm training transferred to the combined balance and manual dual-task. These findings highlight the foundational importance of balance control and the utility of balance training to improve performance of multi-task activities common to daily life.

Sport and Exercise Psychology

Title: Automaticity and physical activity motivation

Organizer: David E. Conroy, Pennsylvania State University

Automaticity and physical activity motivation

The objective of this symposium is to stimulate discussion and debate on the role of automatic processes in regulating physical activity. Dual-process theories proliferate the broader psychological literature but contemporary physical activity theories largely emphasize controlled motivational processes (e.g., efficacy beliefs, intentions, implementation plans). As the boundary conditions of these theories come into focus, automatic processes are attracting increasing attention. These processes have been used to explain physical activity directly as well as components of behavior which are less controlled. The presentations in this symposium approach automaticity from a variety of perspectives. The first two presentations focus on an automatic perceptual mechanism of behavior. The first presentation highlights the intention-behavior gap and demonstrates (with two samples) that physical

activity habit strength differentiates unsuccessful from successful intenders. The second presentation on how habit strength and exercise norms interact to influence post-exercise affective responses. The third and fourth presentations focus on automatic evaluative and motivational mechanisms of physical activity. The third presentation shows that naturally occurring changes in automatic evaluations of physical activity are associated with changes in both self-reported and direct measures of physical activity during a two-week period. The fourth presentation presents a compelling pair of experiments that primed autonomous motivation for exercise to enhance effort and duration during a self-paced exercise circuit. Collectively, these studies illuminate all three theorized mechanisms of automatic behavior and draw a contrast between the controlled and automatic processes that regulate both physical activity and its affective consequences. A leading physical activity scholar will conclude the session by providing a critical discussion of these findings.

Automaticity and physical activity motivation: Affective responses to exercise performance across levels of exercise automaticity

de Bruijn, Gert-Jan, Amsterdam School of Communication Research; Grove, Bob, University of Western Australia

Affective responses are relevant constructs in understanding exercise behavior and automaticity. No research exists that has investigated how pre-exercise and postexercise affective responses differ across profiles created from exercise automaticity and follow-up exercise behavior. The present study therefore investigated relationships between these affective responses and exercise behavior and habit strength. Data were available from a sample of undergraduate students ($n = 288$, mean age = 21 years, 69% female). Baseline data included exercise habit strength and affective attitudes towards exercise behavior in the next two weeks. Follow-up data (= baseline + 2 weeks) included exercise behavior in the past two weeks and affective attitudes towards exercising in the past two weeks. Participants were categorized according to baseline exercise habit strength (low-medium-high) and follow-up exercise norm (yes vs. no). The exercise habit strength-exercise norm distribution was asymmetric ($p < .001$), with no participants with weak habits meeting the exercise norm. Further, half of the participants with strong exercise habits did not report sufficient exercise behavior at follow-up. There was a main effect of exercise habit strength ($p < .001$, $\chi^2 = .20$) on affective attitudes towards exercise behavior in the next two weeks with more positive attitudes amongst those who had stronger exercise habits. Regarding post-exercise affective responses, results showed a main effect of exercise norm ($p < .001$, $\chi^2 = .07$) and exercise habit strength ($p < .001$, $\chi^2 = .16$), with more positive affective responses for those who had stronger exercise habits or met the exercise norm. Moreover, a significant norm $\times$ habit strength interaction ($p = .016$, $\chi^2 = .02$) indicated that differences in post-exercise affective responses between those who met the exercise norm versus those who did not was stronger amongst those who had stronger exercise habits. Post-exercise affective responses are relevant for understanding the link between exercise habits and exercise behavior.

Automaticity and physical activity motivation: Priming motivation in an exercise setting—Considering different techniques and individual differences

Banting, Lauren K., Victoria University; Dimmock, James A., University of Western Australia; Polman, Remco, Victoria University

Priming autonomous motivation via stimulus presentation can be an effective way to increase participation in exercise and the quality of that participation. Investigations into types of priming and their influence on an individual's behavior in an exercise setting have the potential to inform health promotion efforts and exercise program development. Study 1 compared priming through word presentation, picture presentation and a word game activity. Four groups, a neutrally primed (n = 38) and three autonomously primed groups; a word presentation group (n = 40), a picture presentation group (n = 41) and a word game priming group (n = 39) completed their respective priming task (or control task), a self-paced exercise circuit and a post-exercise questionnaire. The effect of the prime on duration of exercise, heart rate during the exercise, enjoyment of the task (self-paced circuit class) and rating of perceived exertion was assessed in this study. It was found that the priming tasks using word presentation and word games had the strongest effect on behavior, with increases in heart rate and duration of exercise observed. The second study replicated the first; however, only word presentation priming (n = 60) was used and compared to a control condition (n = 66). Participants also completed a lexical decision task designed to quantify their implicit exercise motivation. Results were assessed based on the individual's implicit motivation and the priming task. For individuals with high autonomous implicit motivation, there was a small effect of the autonomous prime in all outcome variables. Individuals with low autonomous implicit motivation, or no dominant implicit motivation were moderately affected by the autonomous prime. Results indicate that for individuals with high levels of autonomous motivation, priming is ineffective but perhaps unnecessary. For individuals with low amounts of autonomous motivation, or higher amounts of controlled motivation, autonomous priming can be an effective means of increasing the quality of an exercise session.

Automaticity and physical activity motivation: Automaticity as a predictor of exercise action control

Rhodes, Ryan E., Nasuti, Gabriella; Fiala, Bonnie; University of Victoria

Action control models have received recent support in the exercise domain due to their focus on predicting the intention behavior gap. Exercise automaticity may be a predictor of action control because it represents the efficiency of performing previously intended behaviors from external cues. Thus, the purpose of this study was to examine automaticity as a predictor of exercise action control in comparison to social cognitive predictors. Participants were a random sample of 263 college students and a sample of 121 adult education students who completed theory of planned behavior and automaticity measures at time one, followed by the Godin Leisure Time Exercise Questionnaire two weeks later. Participants were classified into the three action control profiles: 1) nonintenders (14.1% sample 1 and 23.5% sample 2), 2) unsuccessful intenders (35.5% sample 1 and 24.5% sample 2), and 3) successful intenders (48.6% sample 1 and 52% sample 2). Discriminant analysis identified one function that significantly distinguished among the three groups [sample 1 canonical r = .64, χ^2 (10) = 121.45, $p < .01$; sample 2 canonical r = .52, χ^2 (8) = 34.42, $p < .01$]. Affective attitude [sample 1 η^2 = .27, sample 2 η^2 = .08], and perceived behavioral control [sample 1 η^2 = .22, sample 2 η^2 = .09] were predictors of all categories. Automaticity [sample 1 η^2 = .13, sample 2 = η^2 = .17] predicted only action control (i.e., unsuccessful intenders from successful intenders) specifically. The results support the notion that some properties of exercise may have an automatic component and that habits may be important to physical activity action control.

Automaticity and physical activity motivation: The stability of implicit attitudes toward physical activity and their relations with physical activity

Hyde, Amanda L.; Elavsky, Steriani; Doerksen, Shawna E.; Pennsylvania State University

Automatic processes can extend our understanding of physical activity motivation by accounting for spontaneous, effortless, and nonvolitional physical activity that is not under conscious control. Previous research demonstrated that automatic attitudes predict physical activity, but the dynamic nature of automatic attitudes and its impact on physical activity has not yet been investigated. We tested (1) the stability of automatic attitudes toward physical activity and (2) how changes in those attitudes related to physical activity. A sample of 164 university students completed an implicit measure of their physical activity attitudes and a self-report measure of previous week physical activity at the beginning and end of a week; they also wore a pedometer during the week. Structural equation modeling indicated that automatic attitudes have both stable and unstable components over a one-week interval ($\beta = 0.35$). A set of linear regression models revealed that people whose automatic attitudes started less-favorable-than-average but became more-favorable-than-average over the week tended to have (a) a larger increase in self-reported physical activity from the previous week ($b = -1177.26$) and (b) more objectively monitored physical activity than people whose automatic attitudes remained stable or became less favorable ($b = -2611.76$). These results suggest that automatic attitudes toward physical activity are dynamic and that when automatic attitudes become more favorable, physical activity behavior increases. Given that automatic attitudes change and their dynamics are intertwined with physical activity, these attitudes should be targeted in physical activity promotion interventions. In a nation that continues to be plagued by numerous health problems associated with inactivity, these efforts to understand and promote physical activity motivation through innovative theoretical pathways are essential.

Title: Cheating in sport science: A case study and panel discussion

Organizer: Glyn C. Roberts, Norwegian University of Sport Sciences

Cheating in sport science: A case study and panel discussion—The unmasking of a data cheat

Roberts, Glyn C.; Norwegian University of Sport Sciences

Four colleagues and I (PI) proposed and were funded by the Norwegian Research Council (NFR) for over a million dollars to study male and female participants of youth club sports in the Oslo area. We looked at the effect of the motivational climate created by the coach on well-being and ill-being of young adolescents in sport. We measured quality of peer relationships, loneliness, affect, empowerment, bullying and dropping out. We hired a project director and collected data at the beginning and end of the appropriate season. During the project (3 years), the PD's responsibility was to recruit the teams with our help, to administer the questionnaires, to scan the questionnaires and set up the SPSS data sets for us. This he did, and left to take a position at another university after the project was over. During our data analyses for publications, a colleague questioned the scoring of the bullying scale. It was fine, but the investigation revealed other inconsistencies and possible data fabrication. The research team had an exhaustive 3-month investigation, including

interviews with the PD (who consistently denied wrongdoing) and concluded that the evidence strongly suggested data fabrication. As required, we reported the findings to the University. In this talk, I will describe what we did to uncover the inconsistencies in the data, prove it was fabricated, and set in motion the challenging aftermath of this discovery.

Cheating in sport science: A case study and panel discussion—The responsibilities of universities to respond to data fraud.

Lemyre, Nicolas; Norwegian University of Sport Science

After the infamous Jon Sudbø data fabrication case (still the worst case of data fraud ever), Norway made a national policy that every university had to set up an ethics committee to monitor cheating in science. Consequently, the Norwegian University of Sport Science was required to submit the report from Roberts and colleagues to the ethics committee. They appointed an investigative team with two external experts (from medicine!), chaired by a high court judge. The investigative committee took 3 months to prepare their report, after extensive interviews. They concluded that fraud had occurred. As required by law, they submitted their report to the university, the funding agency, and the Ministry of Education. They made it clear that the PD was guilty, and in part they concluded that the research team should have known of the data fraud earlier, and criticized the PI and the research team. The PD was forced to resign his university post immediately, and cannot ever hold an academic position in Norway. However, there were several issues that came out of the process: The investigative team was inclined to "shoot the messenger" and they recommended draconian measures to monitor colleagues to make sure it does not happen again. This raises concerns relative to academic freedom, the appropriate climate for research productivity, and the role of the PI to monitor colleagues.

Cheating in sport science: A case study and panel discussion—Panel discussion

Roberts, Glyn C.; Norwegian University of Sport Science

Rising from the case study, the panel (Richard Magill, Alan Smith, Glyn Roberts, Nicolas Lemyre) will discuss several issues of import to the conduct of scientific research within Universities. In any research team, what is the role of the PI to monitor the data collection procedures of colleagues? How can we make reporting of scientific misconduct easier without "inappropriate blowback" to the scientist making the accusation? How should universities respond to allegations of scientific misconduct? Using other high profile cases of scientific misconduct, the panel will discuss means to investigate and deal with scientific cheating.

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Title: Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children

Organizer: Jacqueline Goodway, Ohio State University

Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: Introduction

Goodway, Jacqueline, Ohio State University; Stodden, David, Texas Tech University

The purpose of this symposium is to examine the relationship between motor competence, perceived motor competence, and physical fitness in typical weight and obese children. The first part of the symposium will describe a conceptual model describing the dynamic relationship between motor competence, physical activity, perceived motor competence, physical fitness and obesity. The relationships among these variables are developmental and dynamic changing from early (4-5 years) to middle (7-8 years) to later (10-11 years) childhood. The latter part of the symposium will provide empirical evidence around the relationships in the model in an ethnically diverse cross sectional sample of children aged 4 to 13 years in USA and preschool and primary-aged children in Belgium. Data from the USA will examine the relationship between actual motor competence and perceived motor competence in children (4-8 years), and between actual motor competence and health-related fitness across childhood (4-13 years). Data from Belgium will examine the relationship among actual motor competence and overweight/obesity across childhood and the relationship between motor competence and weight status during the transition from preschool to primary school. The symposium will conclude with a reflection on the utility of the conceptual model and current empirical evidence in developing evidence-based motor interventions across childhood.

Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: Developmental and conceptual model of the underlying mechanisms

Goodway, Jacqueline, Ohio State University; Stodden, David, Texas Tech University; Brian, Ali, Ohio State University

A conceptual model has been developed that describes the dynamic and synergistic role that motor competence plays in driving physical activity across childhood (Stodden et al., 2008). This model examines the relationship between motor competence, physical activity, perceived motor competence, health-related fitness and obesity across early, middle, and later childhood. At heart of the model is a reciprocal and developmentally dynamic relationship between physical activity and motor competence. This relationship varies and strengthens across time developmental time. In early childhood the relationships will be weak but by later childhood motor competence will be an underlying mechanism driving physical activity behaviors. Other important factors in the model include perceived motor competence and health-related fitness and all four of these variables dynamically interact. Across developmental time children with low motor competence will be drawn into a negative spiral of disengagement as compared to their motor competent peers who will be driven by a positive spiral of engagement. The key dynamic concepts of the model will be described along with the current status of empirical evidence supporting this model.

Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: Relationships among product- and process-oriented measures of motor skill competence and perceived competence in young children

True, Larissa, Michigan State University; Stodden, David, Texas Tech University; Goodway, Jacqueline, Ohio State University;

Perceived motor competence (PMC) is an important mediating variable that influences the relationship between motor skill competence (MSC) and physical activity in youth

(Barnett et al., 2008). Relationships among PMC and MSC in youth (4-16 years) have primarily been examined using process-oriented measures of MSC. Relationships among product scores of fundamental motor skills and PMC have not been examined. This study examined relationships among product- and process-oriented measures of MSC and PMC in 131 boys and girls ages 4-5 and 7-8. Process measures of MSC were determined using the TGMD-2. Product measures were throwing and kicking speed, jumping distance, hop stride length, and run speed. PMC was determined using the physical competence subscale of Harter and Pike's (1984) Pictorial Scale of Perceived Competence and Social Acceptance. Data were analyzed by age and gender on composite TGMD and product MSC indices as well as by locomotor and object control subscales using Pearson's bivariate correlations. No significant relationships between PMC and MSC were found in the 4-5 year old girls; however, 4-5 year old boys demonstrated a moderate correlations between PMC and the compositeTGMD-2 score ($r = .58$, $p < .01$) and PMC and the composite product score ($r = .42$, $p < .01$). Girls aged 7-8 years demonstrated moderate correlations between PMC and compositeTGMD-2 scores ($r = .51$, $p < .01$). Boys aged 7-8 years demonstrated a moderate correlations between PMC and total product score ($r = .43$, $p < .01$). When conducting the same analyses using locomotor and object control subscales separately, PMC was moderately correlated with locomotor and object control product and TGMD scores ($r = .40$ - $.58$, $p < .01$) for 4-5 year old boys, but only for product scores in 7-8 year old boys ($r = .38$–$.40$, $p < .01$). Girls demonstrated significant correlations between PMC and locomotor score, ($r = .64$, $p < .01$), but only in 7-8 year olds. Future research should examine how boys and girls develop perceptions of their motor skill competence based on process- vs. product-oriented MSC outcomes.

Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: The relationships among motor skill competence and health-related fitness across childhood

Stodden, David, Texas Tech University; Langendorfer, Stephen, Bowling Green State University; Goodway, Jacqueline, Ohio State University; Ferkel, Rick, Texas Tech University; Gao, Zan, Ohio State University

A conceptual model by Stodden et al., (2008) suggests that the relationship between motor skill competence (MSC) and health-related fitness (HRF) strengthens from early childhood to adolescence. This study examined relationships among MSC and HRF from early childhood to early adolescence. A total of 456 (253 boys, 203 girls) children (4-13 years) were tested on four health-related fitness tests (PACER, curl-ups, push-ups and grip strength) and product measures on three fundamental motor skills (throwing velocity, kicking velocity, and standing long jump). Data were analyzed across five age groups (4-5, 6-7, 8-9, 10-11, and 12-13). Hierarchical multiple and individual regression models addressed relationships among MSC and HRF aggregately including all three skills, as well as by each individual skill. The overall regression model for the entire sample showed that all three skills were significant predictors for HRF (throw, $t = 6.10$; kick, $t = 4.10$; jump, $t = 2.99$) beyond the age effect ($t = 6.82$), with gender not being a significant predictor. Predicted variance in HRF by MSC generally increased over developmental time (age groups), with the exception of jump distance. These data support other research demonstrating significant relationships among MSC and HRF in children and adolescents. It is the first study to demonstrate that relationship strengths generally increase over time. These data also indicate object control skills may emerge as stronger predictors of HRF as children transition to adolescence.

Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: The relationship among actual motor competence and overweight/obesity across childhood

D'Hondt, Eva, Ghent University; Deforche, Benedicte, Vrije University Brussel; Gentier, Ilse, Ghent University; Lenoir, Matthieu, Ghent University

An adequate level of motor skill competence is considered a key factor in children's general development as well as the foundation for a physically active lifestyle. In turn, physical activity is a central component in both prevention and treatment of childhood overweight/obesity, which has become a global epidemic. Greater insight into the actual motor competence of children who are overweight/obese across developmental time is therefore required. This cross-sectional study investigated differences in gross motor coordination among normal-weight ($N = 477$), overweight ($N = 360$) and obese children ($N = 117$), stratified in three consecutive age groups (5-7, 8-9, and 10-12 years). Weight status was defined according to the IOTF cut-off points (Cole et al., 2000), while gross motor coordination was assessed by means of the KörperkoordinationsTest für Kinder (KTK) (Kiphard & Schilling, 1974/2007). Childhood overweight and particularly obesity were found to result in poorer KTK performances ($p < 0.001$). In the absence of targeted initiatives, BMI-related differences in gross motor coordination were more pronounced in older age groups ($p < 0.01$). In a subsequent longitudinal study, using the same methods, there was an increasing difference in KTK performance of overweight/obese children versus normal-weight peers with increasing age ($N = 50$ per group, 8.2 ± 1.2 years at baseline; $p = 0.012$). A stepwise multiple linear regression analysis further demonstrated that, in addition to BMI per se (37.6%), participation in organized sports (6.8%) predicted children's level of gross motor coordination over a time frame of two years ($p < 0.001$). These findings clearly indicate the crucial need for an early focus on improving motor skill competence in (overweight/obese) children, especially when they are not practicing organized sports. Future research is warranted to establish the mechanisms underlying motor incompetence associated with childhood overweight/obesity and identify additional targets to promote regular physical activity within this population.

Examining the dynamic relationship between motor competence, perceived motor competence, and physical fitness in children: The relationship between motor competence and weight status during the transition from preschool to primary school

Gentier, Ilse; D'Hondt, Eva; Van Cauwenberghe, Eveline; Cardon, Greet; Deforche, Benedicte; Lenoir, Matthieu; Ghent University

Background: Mastering fundamental motor skills is an important step towards performing more specific and complex motor skills that are needed in popular sports and physical activities. Early childhood is a critical timeframe to develop and acquire these fundamental motor skills. However, little is known about motor competence and its relationship to overweight in the preschool period. Purpose: Therefore, this one-year-follow-up study examined whether changes in motor competence depended on weight status during the transition from preschool to primary school. Methods: 153 toddlers' gross motor competence was assessed two times by means of the KörperkoordinationsTest für Kinder (KTK) (Kiphard & Schilling, 1974/2007) within a one-year interval period. An overall motor quotient (MQ)

standardized by age and gender was obtained. Children's weight status (normal-weight (NW) or overweight (OW)) was determined according to the IOTF cut-off points relative to age and gender (Cole et al., 2000). Results: In preschool, the NW (MQ = 88.10 ± 13.47) and OW (MQ = 88.41 ± 14.70) children did not differ in the overall MQ ($p = 0.930$). However, one year later in primary school significant differences ($p = 0.043$) in the overall MQ was observed between the NW and OW children (NW = 94.62 ± 15.47; OW = 86.59 ± 13.77). Conclusion: The transition from preschool to primary school seems to be accompanied by an increase in motor competence in the NW group. However, no differences for the OW group were observed. In line with other studies of D'Hondt et al. (2010, 2012) this gap between the NW and OW children's motor skill level will probably become wider with increasing age. In order to prevent this, targeted motor skill initiatives have to be implemented during early childhood, especially in OW children. Improving the motor competence level of these children could be an appropriate strategy to reduce OW and to promote physical activity participation. Still, the importance of motor competence as a gateway to improve physical activity levels of OW children warrants greater investigation.

Sport and Exercise Psychology

Title: An overview of physical self-conscious emotions: Theory, measurement, and prediction of physical activity

Organizer: Catherine M. Sabiston, McGill University

An overview of physical self-conscious emotions: Theory, measurement, and prediction of physical activity

Sabiston, Catherine M.; McGill University; Kowalski, Kent C.; University of Saskatchewan

In this symposium, the presenters will provide an overview of physical self-conscious emotions expanding on the predominant focus of social physique anxiety. Emotions of shame, guilt, authentic and hubristic pride, and envy will be defined and described using data from nearly 1000 young adult participants collected in multiple studies using quantitative and qualitative methodologies. In the first presentation, the iterative process of scale development, using narrative data, expert review, and preliminary testing among young adults will be described. The measure was developed to assess self-conscious emotions (shame, guilt, and pride) targeting both appearance and fitness physical self contexts. The second presentation is focused on the two facets of pride as experienced in fitness contexts and the association to physical activity among young adults. In this study, the Organismic Integration Theory is used as a framework to understand the association between emotion and physical activity behavior. The third presenter will introduce the emotion of envy as it pertains to the physical self and summarizes narrative data collected to better understand the experience of envy. The antecedents and triggers, contexts, appraisals, and outcomes of body-related envy are described. The presentations will be tied together with a discussion of the theoretical, methodological, and practical applications for studying physical self-conscious emotions. Future directions for this line of work will be offered to help advance the study of self-conscious emotions in spot and exercise psychology.

An overview of physical self-conscious emotions: Theory, measurement, and prediction of physical activity—Development of the Body-Related Self-Conscious Emotions (BSE) Scale

Castonguay, Andree; Sabiston, Catherine M.; McGill University

The purpose of this study was to develop a self-report measure of body-related shame, guilt, and authentic and hubristic facets of pride for use in both fitness and appearance contexts. A rigorous and multiphase approach was used. First, 81 items were developed based on qualitative narratives and phenomenological ratings from 602 males and females, self-conscious emotions and body image theories, and existing measures. Second, a 7-point Likert scale response format ranging from 1 (*never*) to 7 (*always*) was developed. Colleagues ($N = 4$) in body-related self-conscious emotions reviewed the initial items and scale for wording, comprehension, and content. Several modifications were made. Third, the intended target population of older adolescents and adults ($N = 33$; 18.2% male; $M_{age} = 24$ years) completed the questionnaire and reviewed the items for clarity and comprehension and provided qualitative feedback. Items were modified and the scale stem was changed to a 5-point scale due to low endorsement of end points and qualitative responses. Fourth, the content of the items and scale were reviewed by a panel of experts ($N = 11$; $M_{experience} = 11$ years, range = 1-26 years) in the fields of self-conscious emotions (46%) and body image (36%) or both (18%). Experts completed a matching task, as well as an item relevance check sheet, and a scale representation check sheet, and provided qualitative feedback. Items and scales with low content validity indexes were either deleted or modified resulting in 48 items. These items were distributed to males and females ($N = 154$) and examined for mean levels, *SD*, variance, distribution, and endorsement frequency. Inter-item correlations for appearance and fitness scales ranged from .42 to .86 and .27 to .83, respectively. Item-total correlations were = .40 and Cronbach alphas were high for fitness ($\alpha = .91–.93$) and appearance ($\alpha = .88–.94$) scales. The development and validation of the BSE scale may have strong implications for the advancement of body-related self-conscious emotion research.

An overview of physical self-conscious emotions: Theory, measurement, and prediction of physical activity—An organismic integration theory perspective on the relationship between pride in one's fitness and physical activity

Gilchrist, Jenna, Brock University; Mack, Diane E.; Brock University; Sabiston, Catherine M.; McGill University; Wilson, Philip M., Brock University

Pride is a positive self-conscious emotion displayed in response to success or mastery (Lazarus, 1991). Authentic and hubristic pride are proposed to be distinct emotional experiences elicited by divergent cognitive processes and are associated with distinct thoughts and feelings (Tracey & Robins, 2007). While pride experiences have been predominantly studied as a global construct, Leary (2007) advocated for increased empirical attention to the domain specific motivating effects of pride. Building on Leary (2007) and guided by Organismic Integration Theory (OIT; Deci and Ryan, 2002), the purpose of the present study was to examine the associations between pride contextualized to fitness and behavioral regulations for engaging in exercise. Associations between authentic and hubristic pride and frequency of intense physical activity (PA) were also considered. Employing a cross-sectional design and non-probability based sampling, undergraduate students ($N = 146$; $M_{age} = 21.06$ years; $SD_{age} = 2.60$) completed a measure of pride in the context of fitness (Castonguay et al., 2011), the Behavioral Regulation in Exercise Questionnaire 2 (Markland

& Tobin, 2004) and a single-item sweat index (Godin & Shephard, 1985) as a proxy measure of assessing one's frequency of engaging in intense PA. Pride, regardless of the authentic or hubristic underlying nature, was associated with more autonomous (*r*'s 12 ranged from .51 to .60) as opposed to controlled (*r*'s 12 ranged from -.05 to -.17) regulations for exercise. More frequent intense PA was associated with greater authentic ($r = .44$) and hubristic ($r = .42$) pride. Overall results offer preliminary support for the role of pride in advancing our understanding of regulations for exercise and PA behavior. The utility of understanding authentic and hubristic pride in fitness contexts for the purposes of advancing measurement and exercise promotion are discussed.

An overview of physical self-conscious emotions: Theory, measurement, and prediction of physical activity—Exploring psychological experiences of body-related envy

Pila, Eva; Stamiris, Angela; Castonguay, Andree; Sabiston, Catherine M.; McGill University

Based on social comparison theory (Festinger, 1954), individuals have a drive to compare themselves with others in order to evaluate their own attributes. Social comparison often occurs in the context of the physical self (Leahey, Crowther, & Mickelson, 2007). Appearance-focused upward social comparisons occur when individuals compare themselves to those they perceive to possess better physical attributes, and has been linked to body dissatisfaction. These upward social comparisons can be studied theoretically as emotional experiences of envy. Specifically, envy arises from a desire for what a similar other possesses and occurs in domains that are important to the self (Smith & Kim, 2007). The purpose of this research was to examine the experience, contexts and antecedents of body-related envy. Of the 324 older adolescent and young adults recruited, 200 reported open-ended narratives of a body-related envy experience. Based on the narrative data, participants experienced body-related envy following comparisons to the romantic, athletic, and social successes of others (which they attributed to the others' physiques). Envy was triggered in physique- salient contexts, such as trying on clothes, working out, or visiting the beach. Participants used cognitive distortions such as rationalization, justification, and projection to explain experiences of envy. Reports of low perceived control to change an undesired attribute were linked with a sense of unfairness, injustice, and helplessness, while reports of high perceived control were linked with increased motivation for behavior change. Individuals who chronically experience envy have reported poorer physical health, decreased ability to cope with stressors, depression, anxiety, and low self-esteem. Given these health implications and the numerous opportunities for physique comparison in sport and exercise, it is imperative to better understand the envy experience.

Title: Towards an integrated perspective in officiating research

Organizer: Geoffrey Schweizer, University of Heidelberg

Towards an integrated perspective in officiating research

MacMahon, Clare, Victoria University; Plessner, Henning, University of Heidelberg

In recent years, the number of publications addressing officiating research from a psychological, expertise and cognition point of view has increased many times over the previous

10 years. This has led to a significant development of this subfield of study in which there is now research beyond description, towards understanding mechanisms and training (cf. Bar-Eli, Plessner &Raab, 2011). This symposium will illustrate the most current work in the area, and as a whole provide an integrated perspective of the methods used to study performance and training in this unique field in which performers have complex demands. It addresses visual attention behaviors of referees at different levels of expertise (Hancock & Ste-Marie), influences of prior experiences, such as embodiment effects (Raab & Pizzera), and the potential of video training-programs (Schweizer, Plessner & Brand). Together, the symposium presents some interesting and creative studies with promising results that could pave the avenue towards an integrated perspective in officiating research.

Towards an integrated perspective in officiating research--Self-Reported visual attention behaviors of elite, intermediate, and novice ice hockey referees

Hancock, David J., Queen's University; Ste-Marie, Diane, University of Ottawa

Athletes make numerous decisions during competitions, which directly or indirectly impact the outcome (Abernethy & Russell, 1987; McPherson, 2000). Similarly, sport officials make frequent decisions as they attempt to manage the competition (Helsen & Bultynck, 2004; MacMahon, Helsen, Starkes, & Weston, 2007). Interestingly, fewer studies exist that examine sport officials' decision-making compared to studies for athletes. In particular, there is a general lack of understanding of sport officials' decision-making and how visual attention impacts decisions. The purpose of this study was to investigate self-reported visual attention for a specific group of sport officials—ice hockey referees. Two elite, 2 intermediate, and 2 novice ice hockey referees wore helmet cameras for one game and participated in stimulated recall interviews (Gilbert & Trudel, 1999). Participants were asked what they were looking at, why they were looking there, and how that helped or hindered decision-making. Coding (Charmaz, 2006) revealed 4 theoretical codes related to visual attention: 1) Divided attention (referees purposely moved their attention from one area to another); 2) selective attention (referees focused on a particular situation); 3) spatial location (the interplay between the referees' position on the ice, game context, and visual attention); and 4) influences on visual behaviors (referees changed visual attention based on in-game changes). All 4 theoretical codes were discussed by participants; however, there were differences amongst referee groups. For example, under the theoretical code of Spatial Location, elite referees reported using game context to help decide where to position themselves and where to watch on the ice whereas novice referees indicated that context did not impact visual attention. In the discussion, we outline how the 4 theoretical codes add to our knowledge of referees' decision-making and visual attention and offer suggestions for future research based on the findings.

Towards an integrated perspective in officiating research—Embodiment effects in sport judges and referees

Raab, Markus; Pizzera, Alexandra; German Sport University Cologne

Studies have shown a positive relation between motor experiences (ME) and visual experiences (VE) and the visual analysis of human movements (Loula et al., 2005). In a research program we aimed at showing this link between the perceptual judgments of sports officials and their ME and VE. In Study I decision-making performance of soccer experts was assessed in a video test. Experts with a higher amount of general VE showed

better decision-making accuracy, $t(38) = 3.40$, $p = .002$, $d = 1.07$, and time, $t(38) = 2.02$, $p = .051$, $d = .64$ than experts with a lower amount. Specific ME (manipulated through dive training) showed no effects. In study II we assessed judging performance of 56 gymnastic judges using a video test. Judges who were able to perform the skill themselves (specific ME) were significantly better in judging that skill than judges without specific ME, $t(54) = 4.19$, $p < .001$, $d = 1.24$. The aim of study III was to test whether these results also hold for a different set of sports officials, pole vaulting judges. Their task is to judge whether an athlete stabilizes or puts back the cross bar while crossing it. Preliminary data show no differences between participants with pole vaulting experience and without, and between judges and non-judges. However, there was a significant positive relation between the participants' amount of ME ($r = .37$, $p = .007$) and judging experience ($r = .28$, $p = .036$) and the certainty rates concerning their judgments. The current set of studies shows a link between the sports officials' motor, visual and judging experiences and their perceptual judgments which depends highly on the respective sport. Sport associations should use this knowledge for their educational programs to enhance and optimize perceptual judgments on the field or in the gym.

Towards an integrated perspective in officiating research—Establishing standards for basketball elite referees' decisions

Schweizer, Geoffrey; Plessner, Henning; University of Heidelberg; Brand, Ralf; University of Potsdam

In literature on refereeing, conformity to the judgments of others, either for normative or informative reasons, is usually understood as an undesirable bias (Vanden Auweele, Boen, De Geest, & Feys, 2004). Contrarily, we propose a perspective towards conformity as an advantageous phenomenon in environments of high uncertainty. From this perspective, the question is how can conformity be supported? Basketball referees must be able to adjust their interpretations of ambiguous incidents to the interpretations of their fellow referees to make their decisions predictable. In other words, basketball referees' decisions in ambiguous situations are supposed to adhere to common standards. We propose that standards can be established by video training-programs. Thirty-three German elite basketball referees participated in an online experiment. Feedback during a learning phase influenced decisions (foul vs. no call) in a subsequent test phase. Referees adjusted their decisional criterion according to feedback in the learning phase. Results suggest that establishing standards for referees' decisions in ambiguous situations may be a worthwhile approach for improving the quality of referees' decisions.

Motor Learning and Control

Title: Understanding interpersonal motor coordination: Sharing representations or sharing dynamics

Organizer: Richard C.Schmidt, College of the Holy Cross

Understanding interpersonal motor coordination: Sharing representations or sharing dynamics—Creating a dialog between perspectives on interpersonal motor coordination

Schmidt, Richard C.; College of the Holy Cross

The coordinating of movements between people in sports or any physical activity requires that the participants have shared goals, are committed to those goals and are mutually responsive to each other's actions. Cognitive theorists propose that such interpersonal coordination is the consequence of shared knowledge instantiated in the form of shared mental/neural representations. Such shared representations provide a basis for the simulation of another's actions, and consequently, for the ability to predict and anticipate another's behavior. Although this shared representation theory has prompted considerable research, concerns have been raised that the approach does not specify the causal process by which the coordination is produced but merely assumes neural representations that have just the organization needed to produce the behavior. Alternatively, behavioral dynamics theorists have proposed that the intentionality and mutual responsiveness inherent in interpersonal coordination needs to be understood as the result of shared dynamics, i.e., through nonlinear interactions written across interactors that can be modeled using the tools and theory of nonlinear dynamics and self- organizing systems. From this perspective, the causal processes of interpersonal coordination are captured by lawful dynamical principles (such as synchronization) that can provide a basis for predicting and anticipating an interactor's behavior. The aim of this symposium is to present research from both the cognitive and dynamical perspectives on interpersonal motor coordination as well as to appreciate the efficacy of its study for understanding pathological behavior. We anticipate that this contrasting of viewpoints will help foster greater dialog about the similarities and the differences as well as the strengths and the weaknesses of the differing perspectives on interpersonal coordination.

Understanding interpersonal motor coordination: Sharing representations or sharing dynamics--Spatial perception during game play—Representing the "other" as potential perturbation

Jordan, J. Scott; Kenning, Andrew; Illinois State University

How do people represent each other as they play a game together? The present talk examines this issue by describing experiments in which two participants play a computer game in which they control a stimulus' movements back and forth across a computer screen, and each player has access to one of two control buttons. It is as if one player is controlling the gas pedal while the other is working the brakes. At some point while the pair is working to decelerate the stimulus, the stimulus vanishes, and one member of the pair indicates where the stimulus vanished. Research indicates that the perceived vanishing point of a moving stimulus is displaced beyond the actual vanishing point. This forward displacement (FD) decreases with implied friction (i.e., the stimulus appears to move across a surface). In addition, the implied-friction effect reverses when participants control stimulus movements (via right- and left-key presses) versus observe them. This reversal is consistent with economy-of-action (EOA) effects in which variables such as perceived pitch are influenced by the energy- demands implied by a stimulus (e.g., a steeper hill). And when pairs control the stimulus together, FD increases across implied friction, regardless who controls the stimulus when it vanishes. Since participants are basically observers as the other participant controls the stimulus, the increase of FD during such observation indicates participants perceive the other-controlled stimulus movements in terms implied effort (i.e., EOA). In addition, FD is larger when it vanishes while the "other" participant is in control of it. This self-other difference reveals the 'other' is represented in the "self's" action plans in terms of the potential disturbances the "other" might have on the distal event (i.e., the

movements of the stimulus) the two are jointly controlling. That is, the data reveal EOA effects for the "other."

Understanding interpersonal motor coordination: Sharing representations or sharing dynamics--Interpersonal and team coordination—Perception-action processing vs. perception-action dynamics

Richardson, Michael J.; Kallen, Rachel W.; Coey, Charles; Harrison, Steven J., University of Cincinnati; Schmidt, R. C.; College of the Holy Cross

To influence, play, and coordinate with others is to be human. Indeed, our daily lives constantly entail social activity, whether the activity is navigating between people on a sidewalk, cleaning the house with our family, moving a table with a co-worker, or playing football with friends. The neurocognitive understanding of the complex movement coordination that underlies such behavior is based on a (mechanistic) process oriented hypothesis. Namely, that when individuals observe the movements of a co-actor, that perception activates the alleged neural and representational mechanisms involved in action production. Together with the proposal that individuals represent the goals and intentions of co-actors, this motor activation is then argued to invoke a motor simulation process, whereby the observer covertly 'mirrors' the observed movement in order to predict what a co-actor is doing and will do next. An alternative or complementary hypothesis is that coordinated social action systems reflect soft modeled synergies that are self-organized and emerge from the nonlinear interactions that exist between mind, body and environment. In contrast to the information processing account of social perception-action behavior promoted by the neruocogntive approach, this behavioral dynamics hypothesis seeks to ground an understanding of social perception-action behavior in the lawful properties of animal-environment systems (i.e., physical, biomechanical and informational constraints). Here we contrast these two approaches and present several recent studies aimed at determining whether complex interpersonal, group and team action and coordination can be understood from a behavioral dynamics perspective. Specifically, we will present time-series data that captures the structure and stability of the coordination that occurs between two or more actors performing (a) a joint response task, (b) a rhythmic collision avoidance task, (c) a sorting task, and (d) a team coordination game, all of which highlight the self-organizing dynamics of social action.

Understanding interpersonal motor coordination: Sharing representations or sharing dynamics—Exploring the role of interpersonal motor coordination in the breakdown of shared representations in autism spectrum disorder (ASD)

Fitzpatrick, Paula; Assumption College; Diorio, Rachel; College of the Holy Cross; Richardson, Michael J.; University of Cincinnati; Schmidt, R. C.; College of the Holy Cross

Some research suggests that the impairments in social interaction that affect children with Autism Spectrum Disorder (ASD) may be due to an inability to create shared representations and a mirror neuron system dysfunction may play an important role this impairment. However, other research suggests that children with ASD are capable of understanding intentionality, can demonstrate joint attention, and are capable of imitation. So, how is it possible for children with ASD to demonstrate these social skills based upon shared representations yet still have such profound problems interacting with others in reciprocal social interactions? We explore here whether interpersonal motor coordination may be an important key for unlocking the answer. First, the question of whether children with ASD

are able to demonstrate a skill may be a less important question than how they execute the behavior. If an important dimension of our social connection to others is embodied in the way we move with respect to other people, then an impairment in motor coordination could result in a breakdown in social connection even if a task is "successfully" accomplished. In addition, if how is the important question, the critical behavioral measure is not whether a task is accomplished but how the behavior unfolds over time. Preliminary findings suggest that children with ASD were equivalent to typically developing children in terms of success in accomplishing tasks that required shared representations. However, children with ASD had lower scores than typically developing children on dynamic measures for interpersonal motor coordination and significant correlations were found between some motor coordination and shared representation tasks. These findings point to the promise of interpersonal motor coordination as a pathway for understanding ASD-specific social deficits and disruptions in shared representations.

Friday, June 8

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Title: Innovations for upper extremity stroke rehabilitation: Identifying critical factors for neurorehabilitation

Organizer: Sandy A. McCombe-Waller, University of Maryland

Innovations for upper extremity stroke rehabilitation: Identifying critical factors for neurorehabilitation—Symposium overview

McCombe Waller, Sandy A.; University of Maryland

Rehabilitation of paretic arm function for individuals after stroke continues to be a major challenge. To date, the scientific focus has been on the development and testing of novel training approaches to improve functional outcomes. However, recent RCT findings have demonstrated equivalency between alternative dose-matched approaches indicating that the approach itself is not the key factor to promote recovery. In line with the World Health Organization's ICF model there is an increasing awareness of the need to understand mechanisms related to recovery and to recognize the environmental and personal factors that impact an individual's functional outcomes after intervention. In this symposium we will discuss new directions for neurorehabiliation that seek to identify the critical factors that influence responsiveness to interventions and are likely essential for learning and recovery after stroke. Our first speaker will discuss the testing of combination approaches, the use of non-invasive neurophysiological techniques for prediction, and the need to study recovery in the subacute population. Our second speaker will provide evidence on two emerging approaches which include self-efficacy for movements with the paretic limb and action observation that promotes engagement of the mirror neuron system. our final speaker will explore the use of motivationally optimized instructions and feedback for motor skill practice to address the psychological needs of patients in neurorehabiliation including competence, autonomy and social relatedness. We will conclude with an open forum to discuss challenges and strategies to incorporate these critical factors into research design and clinical practice.

Innovations for upper extremity stroke rehabilitation: Identifying critical factors for neurorehabilitation. Rehabilitation in stroke: Are we reaching in the right direction or groping in the dark?

Whitall, Jill; University of Maryland

Paretic arm dysfunction remains a problem for stroke survivors with many having no functional use of the arm even after conventional rehabilitation. In this talk, I will begin by briefly presenting recently published and newer unpublished data from two UMB research groups: bilateral arm training (Whitall et al., 2011) and robotic arm training (Conroy et al., 2011) that illustrate some problems in our current research agendas. I will argue that we have been groping in the dark but are now beginning to reach in the right direction with three overlapping trends: the testing of combinations and sequential training (including whole body movements), the increased use of non-invasive neurophysiological techniques

for prediction and a needed move to doing research in the sub-acute population. I will argue that we need a fundamental change in how we value rehabilitation research particularly with regard to the pervasive dichotomy of groping to find the optimal rehabilitation technique vs. reaching out into the real-world to optimise and transform clinical practice. Finally, I outline a specific new research line for my own work that includes using advances in sensor technology and statistical modelling.

Innovations for upper extremity stroke rehabilitation: Identifying critical factors for neurorehabilitation. Critical ingredients of successful stroke rehabilitation: Evidence from two viable candidates, self-efficacy and action observation

Winstein, Carolee; University of Southern California

At least three recent phase III randomized control trials (RCT) report no difference in outcomes between dose-matched groups in which the intervention protocols differ. This suggests that the dose of therapy is more important than the specific ingredients of therapy. We discuss findings from two pre-clinical studies that provide promising evidence for two candidate ingredients not before examined in the context of phase III RCT designs. The first is self-efficacy for aiming movements with the paretic arm. We show that a new measure of relative self-efficacy strongly predicts paretic limb choice in a free choice condition (Shu Ya Chen, 2011). The second is action observation and the engagement of the Mirror Neuron System (MNS) as measured with fMRI. We report a set of novel findings for the stroke brain compared to the age-matched non-disabled brain. In particular and unique to the stroke group, as participants with stroke observe actions made by a non-disabled actor using the right (paretic) hand, cortical motor activity is asymmetric, and lateralized toward the left lesioned hemisphere (Garrison, 2011). I will argue that a systematic and incremental approach using hypothesis-driven steps toward revealing important mechanisms of learning and recovery after stroke will be more useful to the scientific and clinical community than several more phase III RCTs in neurorehabilitation.

Innovations for upper extremity stroke rehabilitation: Identifying critical factors for neurorehabilitation—Motivation in support of motor learning and neurorehabilitation

Lewthwaite, Rebecca, University of Southern California; Wulf, Gabriele, University of Nevada

Motivationally optimized instructions and feedback surrounding motor skill practice support learners' fundamental psychological needs for competence, autonomy, and social relatedness. Importantly, these motivational enhancements have been shown to affect motor learning immediately and motor behavior in the longer term. As evidence continues to accumulate that high volumes of task-specific practice aid recovery of arm and hand function after stroke, innovators develop methods for providing that extensive practice, including virtual reality applications, robotics, constraints, activity monitors, and other technologies. Clinicians work to deliver effective interventions in a healthcare climate that limits time with clients. Concurrently, pressures mount to provide care in a patient-centered manner that honors clients' preferences as well as needs. Can these disparate trends converge effectively? Recent research in psychological and movement science as well as neuroscience strongly ties motivational states to motor learning. We discuss a set of published and unpublished studies with varied types of participants from young and healthy to older adults and those with clinical conditions that focus on very brief interventions or manipulations of a moti-

vational nature. These interventions alter learners' mindsets for skill development, raise personal performance expectations, and convey autonomy support to affect motor skill retention and transfer performance. We also consider challenges in bringing key insights to researchers, engineers, and clinicians to take advantage of these emerging findings.

Sport and Exercise Psychology

Title: Moral disengagement in sport and beyond: The gym, the pitch, and the classroom

Organizer: Ian D. Boardley, University of Birmingham

Moral disengagement in sport and beyond: The gym, the pitch, and the classroom

Boardley, Ian D., University of Birmingham

Moral disengagement reflects one's willingness to conditionally endorse transgressive behavior through the use of eight psychosocial mechanisms that minimize negative emotional reactions (e.g., guilt, shame) when transgressing (Bandura, 1991). These mechanisms operate by cognitively reconstruing harmful acts into benign ones (moral justification; euphemistic labeling; advantageous comparison), minimizing personal accountability for harmful acts (diffusion or displacement of responsibility), misrepresenting the injurious effects of transgressive conduct (distortion of consequences), or blaming the character or actions of the victim (dehumanization; attribution of blame). The present symposium discusses the use of moral disengagement in a range of settings including the gym, the sports pitch, and the classroom, and associates its use with an array of morally relevant behaviors such as using illicit performance enhancing drugs, and engagement in prosocial, antisocial, and unethical behavior. The symposium consists of four talks. The first talk presents research examining the role of moral disengagement in facilitating use of illicit performance enhancing drugs in English bodybuilders. The second presentation discusses a study examining the links between self-related variables (i.e., self-worth, perceived physical / social / behavioral competence, guilt / shame / externalization proneness) and moral disengagement and antisocial behavior. The third talk presents research on social identities in youth sport and how these may influence prosocial and antisocial behavior. Finally, the fourth presentation discusses moral disengagement in sport and academic settings, and whether its use is predictive of unethical behaviors in these contexts; antecedents of moral disengagement in each setting, as well as gender and school-level differences are also discussed. Overall, the research described here further supports potential detrimental outcomes of moral disengagement in a number of contexts, and identifies key antecedents associated with its use.

Moral disengagement in sport and beyond: The gym, the pitch, and the classroom—A qualitative investigation of moral disengagement in English bodybuilders

Boardley, Ian D.; Dewar, Andrew; Grix, Jonathan; University of Birmingham

The current study was designed to extend previous work investigating the psychosocial processes facilitating use of performance enhancing drugs in bodybuilders. Applying Bandura's (1991) social cognitive theory of moral thought and action, Boardley and Grix (in revision) completed in- depth semi-structured interviews with nine bodybuilders from a single gym in the West Midlands region of England. Deductive and inductive data analysis

resulted in the identification of nine data themes relevant to Bandura's theory. However, the work of Boardley and Grix is limited in that it investigated athletes from just one gym, and it is therefore not known whether these themes apply more widely. To address this limitation, the present study builds on the work of Boardley and Grix by investigating a much larger sample of male bodybuilders representing all of the nine government regions of England. Data collection is ongoing (target $N = 60+$), but preliminary analysis of data from the 29 interviews conducted to date supports the findings of Boardley and Grix (in revision). Themes identified by Boardley and Grix and supported in preliminary analysis of the current data illustrate the use of six mechanisms of moral disengagement (all except dehumanization and attribution of blame) and suggest use of these mechanisms facilitates justification of use of illicit substances, as well as the psychological nullification of potentially harmful health implications associated with their use. Three further themes also supported in the current data pertain to routinization of doping, family/friends knowledge of athletes' doping, and progression from supplement use to doping. Overall, the current findings extend the findings of Boardley and Grix (in revision) to a large nationally sourced sample and therefore contribute important knowledge on the psychological and social processes that facilitate initiation and continuation of doping in English male bodybuilders.

Moral disengagement in sport and beyond: The gym, the pitch, and the classroom—Moral disengagement and the self in sport

Alerding, Caitlin M.; Smith, Alan L., Purdue University

Moral disengagement, the deactivation of negative self sanctions for transgressive behavior (Bandura, 1991), has been linked to antisocial behavior in sport contexts (see Boardley & Kavussanu, 2011). This has catalyzed interest in understanding what may predispose individuals to morally disengage in sport. In light of the critical role of self- related perceptions and affect in moral functioning (Bandura, 1991; Tangney, 2003), a surprising gap exists in the sport literature regarding moral disengagement and the self. The present study was designed to address this gap by examining potential self-related antecedents of moral disengagement and antisocial behavior. Specifically, self- worth, perceived physical, social, and behavioral competence, and guilt, shame, and externalization proneness were investigated as predictors of moral disengagement and antisocial behavior. Moreover, moral disengagement was investigated as a possible mediator of the associations between the self-related variables and antisocial behavior. High-school lacrosse players ($N = 193$; 71% male; ages 14 to 19 years) completed reliable ($\alpha > 0.70$) and valid self- report measures of the study variables. Multiple regression analysis revealed that perceived behavioral competence, guilt proneness and shame proneness negatively predicted and externalization proneness positively predicted moral disengagement (all $p < .01$), with 38% of moral disengagement variance explained. Perceived physical competence positively predicted and perceived behavioral competence and guilt proneness negatively predicted antisocial behavior (all $p < .05$), with 32% of antisocial behavior variance explained. Moral disengagement and antisocial behavior correlated at $r = 0.69$ ($p < .01$). Finally, moral disengagement at least partially mediated the relationship of multiple self-related variables with antisocial behavior. The current study furthers the sport-based moral disengagement literature by empirically demonstrating the salience of self-related perceptions and affect to moral functioning and antisocial behavior.

Moral disengagement in sport and beyond: The gym, the pitch, and the classroom—Examining the role of social identity and moral disengagement on prosocial and antisocial behavior in youth sport

Bruner, Mark W., Nipissing University; Boardley, Ian D., University of Birmingham; Côté, Jean, Queens University

Sport is a social context that provides youth with opportunities to regulate and engage in moral behaviors (Boardley & Kavussanu, 2011). However, research has not investigated how the social identities that youth form through membership on sport teams may shape moral behavior. In this study, we examined (a) the effects of social identity on prosocial and antisocial behavior toward teammates and opponents in youth sport and (b) whether any effects were mediated by moral disengagement. Male and female youth sport participants ($N = 449$; $M_{age} = 15.75$ years) completed questionnaires at the beginning, middle and end of the season assessing two dimensions of social identity (in-group ties, in-group affect), moral disengagement and prosocial and antisocial behavior toward teammates and opponents. Structural equation modeling indicated that overall in-group affect had a positive effect on prosocial behavior toward teammates, and negative effects on antisocial behavior toward teammates and opponents; all effects were mediated by moral disengagement. Overall in- group ties had positive effects on prosocial behavior toward teammates and antisocial behavior toward teammates and opponents; no effects of in-group ties on the three types of behavior were mediated by moral disengagement. Finally, neither dimension of social identity had an effect on prosocial behavior toward opponents. Taken together, the findings highlight that social identity may have a salient role in the regulation of prosocial and antisocial behavior in youth sport, and that changes in moral disengagement may explain some of these effects.

Moral disengagement in sport and beyond: The gym, the pitch, and the classroom—Moral disengagement and unethical behavior in sport and academics

Gaines, Stacey A., Texas A&M University-Kingsville

Moral development theorists suggest that both moral reasoning and behavior may be influenced by the context in which they occur (see Shields & Bredemeier, 1995). Moral disengagement has emerged as a viable factor to consider when seeking to understand the use of unethical behaviors in sport and academic settings (see Bandura et al., 1996 and Boardley & Kavussanu, 2011). However, no known work has examined the use of moral disengagement by participants in both settings simultaneously. The present study was conducted to examine the relationship between adolescents' use of moral disengagement and their engagement in unethical behaviors in sport and school contexts. Antecedents of moral disengagement in each setting, as well as gender and school-level differences were examined. High school and college athletes ($N = 218$; 58% female) completed psychometrically sound measures designed to assess previously examined antecedents (i.e., moral awareness, goal orientation, commitment, and perceived peer behavior), moral disengagement, and unethical behaviors in both contexts. Multiple regression analyses were conducted, showing task orientation and moral awareness to negatively predict, and ego orientation and perceived peer behavior to positively predict, moral disengagement in both settings. Commitment positively predicted moral disengagement in the academic setting only. Moral disengagement positively predicted self-reported engagement in unethical behaviors in both settings, and

mediated the relationship of the antecedents with unethical behaviors. Participants reported greater use of moral disengagement and engagement in unethical behaviors in school than in sport. Females reported greater use of moral disengagement and engagement in unethical behaviors than males in school, while males reported greater use of moral disengagement and engagement in unethical behaviors than females in sport. No school-level differences were noted. This study extends the moral disengagement knowledge base by identifying contextual and gender differences in the use of moral disengagement.

Motor Learning and Control

Title: Applied skill acquisition: Working with elite athletes

Organizer: Damian T. Farrow, Victoria University and Australian Institute of Sport

Applied skill acquisition: Working with elite athletes—Introduction

Farrow, Damian T., Victoria University and Australian Institute of Sport

Skill acquisition (motor learning and control) has a long research history in the pursuit of issues centred on theoretical significance. However in the last decade or so there has been a concerted effort to apply many of the established skill acquisition theories into practice, particularly in relation to the skill development of elite athletes (see Button & Farrow, 2012; Williams & Ward, 2009 for overviews). This symposium highlights current research covering a broad range of skill acquisition issues of topical interest to coaches working in the elite performance setting. These include understanding movement pattern variability to enhance the performance of Olympic springboard divers (Barris, Farrow & Davids); demonstrating the specific gaze behavior of Olympic speedskaters and its implications for skill refinement (Vickers) and the manipulation of augmented feedback and practice constraints in an elite swimming program (Gorman). All presentations highlight a number of common features of applied skill acquisition research of this kind. Namely, a partnership between the coach and scientist in the formulation of the research question, small participant populations of elite level athletes without accompanying control groups, a strong reliance on the use of multi-disciplinary process measures such as kinematics, kinetics and visual-motor control recorded in situ, and an emphasis on practical rather than theoretical significance. It is argued that this type of research is an equally critical aspect of developing an enhanced understanding of skill acquisition relative to more traditional theoretically driven approaches.

Applied skill acquisition: Working with elite athletes. Principles of ecological dynamics and elite sport performance—Application in springboard diving

Barris, Sian C., Queensland University of Technology; Farrow, Damian T., Victoria University and Australian Institute of Sport; Davids, Keith D., Queensland University of Technology

Consistency and invariance in movements have traditionally been seen as the essential features of motor skill acquisition and elite sports performance. An emphasis on the stabilisation of action has resulted in important processes of movement adaptation in complex tasks being overlooked. Whether athletes should aspire to replicate optimal movement patterns during complex multi-articular tasks remains unclear, since supportive evidence

has historically been obtained under controlled experimental task constraints, with few attempts to study advanced skill acquisition in elite participants. The ability to solve the same motor problem in different ways is especially important in tasks like springboard diving, where the external environment is variable, yet performance success is quantified by repeatable performances. Unlike many other athletic events, springboard diving requires athletes to adhere to imposed movement criterion which dictate how the movement pattern should be performed, forcing athletes to follow an optimal movement pattern to satisfy strict judging criteria. Consequently, contemporary diving training tasks allow divers to 'baulk' when they believe their preparation for a dive take-off is not good enough. By only completing dives that follow an optimal preparation phase, skilled divers may not afford themselves the opportunity to develop adaptive and flexible strategies to achieve a similar performance outcome goal. This study investigated whether significant differences exist between the movement kinematics displayed by elite divers in the preparation phases of baulked and completed take-offs. Additionally, it describes a training intervention to encourage divers to explore the functional variability of the take-off phase by continuing with dives where they would have previously baulked. These findings provide a powerful rationale for coaches to consider functional variability or adaptability of motor behavior as a key criterion of successful performance in diving, rather than the ability of all performers to replicate an ideal movement template.

Applied skill acquisition: Working with elite athletes--The application of augmented feedback and a constraints-led approach in an elite sports setting

Gorman, Adam D., Australian Institute of Sport

The provision of verbal and visual feedback to enhance skill learning is commonplace in many elite training environments. While augmented feedback has been shown to contribute to positive performance changes for individuals learning a relatively new skill (e.g., Janelle, Barba, Frelich, Tennant, & Cauraugh, 1997), less is known about the impact and content of such feedback for facilitating skill changes in the daily training environment of elite level athletes (Chambers & Vickers, 2006; Sanders, 1995). Similarly, the constraints-led approach to coaching (see Davids, Button, & Bennett, 2008; Newell, 1986) is becoming increasingly prevalent in the applied sports training setting but the extent to which such methods are able to elicit changes in elite level athletes remains an important question for practitioners and researchers alike (see also, Chow, Davids, Button, & Koh, 2005; Renshaw, Davids, & Savelsbergh, 2010). To further address these questions, biomechanical measurements (including entry angle and entry distance) were collected from elite swimmers both before and after a training intervention (spanning several months) as they attempted to make changes to their starting techniques. During the intervention period, each athlete was provided with delayed video feedback as well as verbal cues and instructions. This was complemented by the manipulation of various constraints in an attempt to encourage the swimmers to make meaningful and lasting changes to their technique. Inspection of the means after the training period revealed changes in entry angle and entry distance that (while not statistically significant) were consistent with the primary aims of the coaching intervention. The results therefore provided evidence to suggest that elite athletes, competing at the highest level, can benefit from the use of augmented feedback and the judicious application of constraints to make changes to the technique of a well-learned sporting skill.

Applied skill acquisition: Working with elite athletes--Gaze, vestibulo-ocular reflex and skating speed of elite speedskaters

Vickers, Joan N., University of Calgary

The human head is a heavy object, weighing between 3.5 and 5.5 kg and representing approximately 8% of the human body's entire mass. Elite speed skaters have the daunting task of skating at speeds that represent the fastest that humans can achieve under their own power on a flat surface. World-class speed skaters reach speeds of 49 kph, and are therefore constantly pulled by the forces of gravity off the ice. In this study we describe a novel method to counteract the forces of gravity through control of the gaze and vestibular ocular reflex (VOR) during speedskating on an Olympic Oval. We describe how the temporal control of travel fixations (ms), vestibular ocular reflex (ms) and skate stride durations (ms) are timed to achieve optimal speed and control on the ice. Participants analyzed were elite Olympic speed skater skaters, many of whom have won medals at the Turin and/or Vancouver Olympics.

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Title: Motor control and developmental disabilities: Identification, assessment, and interventions

Organizer: Getchell, Nancy, University of Delaware

Motor control and developmental disabilities: Identification, assessment, and interventions

Getchell, Nancy, University of Delaware

When children have chronic mental and/or physical impairments, developmental disabilities often result that impact activities of daily living throughout the lifespan. A broad range of developmental disabilities exist, each of which has a unique impact on motor control. In this symposium, we will explore three different types of developmental disabilities: spinae bifida, cerebral palsy, and developmental coordination disorder. We will focus on issues related to identification and assessment of motor dysfunction as well as novel interventions to improve motor control. Future directions in developmental disabilities research will also be discussed.

Motor control and developmental disabilities: Identification, assessment, and interventions—Segmental contributions of trunk control to sitting, reaching, and stepping in children with cerebral palsy

Saavedra, Sandy, University of Michigan

There is a need to examine control of the trunk as a segmented, multi-joint subsystem involved in skilled behaviors. Motor control experts and clinicians recognize this but; nevertheless, tend to resort to assessing and treating the trunk as a rigid and uniform body "segment." To more accurately assess trunk control and design effective intervention strategies when the level of trunk control among segments varies, we need to understand better how trunk segmental control develops in infants with typical development (TD) and in

children known to display limited trunk control, such as those with cerebral palsy (CP). I will present a series of studies in which we investigated the relation between segmental level of trunk control and sitting, reaching and stepping skill levels. For the first set of studies, electromyography and kinematic data were collected at four levels of trunk support (axillae, mid-ribs, waist, hips), in a longitudinal study of eight infants with TD (3-9 months of age) and in a cross sectional study of 17 children with CP (age 4-17 years). These data showed that patterns of trunk control in children with CP are delayed, but similar to those occurring during development of sitting in infants with TD. We also showed that trunk control leading to sitting balance emerges sequentially from the head downward in typical infants and is constrained at specific segmental levels in children with moderate-to-severe CP. Finally, I will share preliminary results from a set of ongoing projects that explore the contributions of segmental trunk control to reaching and stepping in infants with TD and children with CP. Knowledge about the normal progression of trunk control and its contribution to other functional skills will provide important information for clinicians trying to help children with neuromotor disabilities, like CP, gain sitting, reaching and locomotor skills.

Motor control and developmental disabilities: Identification, assessment, and interventions—Training compliance control in manual actions performed by adults and children

Bingham, Geoffrey P.; Snapp-Childs, Winona; Indiana University

Children with developmental coordination disorder (DCD) exhibit poor compliance control in performance of manual actions like handwriting. This, in turn, often yields illegible handwriting. These children confront a "catch-22" problem when attempting to improve their performance though practice. We present a perceptuo-motor approach to the training of such manual action with a focus on improved compliance control. The first study is a "proof of concept." We compare learning in two groups of adult participants, one performing active and the other passive practice. The results show that active practice is required for effective learning. In the second study, we tested 2nd grade school children in a replication of a previous training study where we compared performance of children with DCD with that of typically developing children. Now we compare performance as a function of pre-training scores on the Beery-Buktenica test. The key idea in these studies is that support must be provided to the performers that allows active generation of movements during practice while breaking the catch-22.

Motor control and developmental disabilities: Identification, assessment, and interventions—Measuring the development of neuromotor control

Smith, Beth, Oregon Health and Science University; Ulrich, Bev, University of Michigan

Impaired neuromotor control is often observed in infants with developmental disabilities, apparent in their delayed onset and unstable movement patterns for skills such as kicking, reaching and sitting. These aberrant from typical behaviors are affected by underlying differences in central nervous system (CNS) structure and function. Concurrently, CNS structure and function is affected by activity through the mechanism of use-dependent plasticity (enriched motor experience or motor experience deprivation). Infants with developmental disabilities often experience some degree of motor deprivation due to lower levels of activity and reduced opportunity for exploration. More encouraging, however, is that they respond positively to enriched motor experience. Accordingly, early intervention

at the activity level should have a positive impact on CNS structure and function and the development of neuromotor control. However, this has been challenging to demonstrate due to the difficulty in measuring neuromotor control, especially early in life. In this session we will discuss promising new techniques for measuring development of neuromotor control. One promising tool for identifying impaired neuromotor control is the nonlinear measure of approximate entropy (ApEn). We recently used ApEn to demonstrate impaired early neuromotor control during spontaneous leg movements in infants with myelomeningocele and found greater impairment in early neuromotor control related to increased delay in walk onset. ApEn provides a way to measure variability in movement that reflects the underlying control of the CNS. Direct measurement of neuromotor activity is also now possible with recent advances in electroencephalography (EEG) and functional near infrared spectroscopy (fNIRS). These techniques afford the exciting possibility of being able to measure changes in CNS function as a result of early activity interventions. We will briefly discuss the current state of EEG and fNIRS for measuring neuromotor control early in life, highlighting possibilities and limitations

Motor control and developmental disabilities: Identification, assessment, and interventions—Hand coordination deficits in individuals with spastic diplegia

Clizbe, David, Kurbi Health; Uygur, Mehmet; Getchell, Nancy; Jaric, Slobodan; University of Delaware

Cerebral Palsy (CP) is one of the most common neurological conditions affecting motor behavior (Thurman, Gwinn-Hardy, et al, 2006). There is a positive correlation between upper and lower limb function (Himmelmann, et al, 2006). The relationship raises questions on the origins of manual dysfunction in individuals with spastic diplegia (SD) a sub-type of CP where spasticity does not significantly influence the hands, yet there are motor deficits. Prior to this study, most of the study on hand function in individuals with CP focused on spastic hemiplegia (SH) (Hadders-Algra, et al, 1999; Hirschfeld, 2007; Steenbergen & Gordon, 2006). These studies suggest that dysfunction may affect the motor control system on a whole and may explain hand dysfunction in individuals with the SD. Hand function was examined in six participants with SD and 6 age/gender-matched neurotypical participants (TD) (mean age: 23.5 years) using the Jebsen Taylor test (examining functional motor deficits in every day tasks) and a bimanual coordination task used to examine grip/load relationships. When comparing groups on the Jebsen Taylor test, significant differences existed in both the dominant and non-dominant hand for both SD and TD groups ($p < .05$). Further, the SD group was significantly slower on each task than TD on most tasks. The bimanual control task included a Simple Lift, and Ramp and Hold, designed to measure the gripping force, the force applied normal to the grip surface, and the load force. Significant results were also seen in force coordination. Differences were found in variables related to task performance and ability to modulate grip force relative to load force. Excessive grip and high variability in hand force production were seen in the SD group and may explain the deficit in the Jebsen Taylor test. These results suggest that hand dysfunction in people with SD might result from an inability to properly execute force sequencing.

Motor control and developmental disabilities: Identification, assessment, and interventions—Can auditory pacing improve period stability and temporal consistency in children with and without co-existing DCD and dyslexia?

Liang, Ling-Yin; Golden, Daphne; Getchell, Nancy; University of Delaware

In the United States, an estimated 5 to 17% of children are diagnosed with dyslexia, making it the most commonly diagnosed learning disability. For a portion of these children, various types of movement deficits exist, often severe enough to classify children as at risk for or having developmental coordination disorder (DCD; Dewey, Wilson, & Kaplan, 2000; Visser, 2003). Some of the more common deficits that children with dyslexia and developmental coordination disorder (DCD) exhibit are timing and automatization deficits in motor skills, suggestive of cerebellar dysfunction. Auditory pacing during a motor task as an intervention may aid performance by providing external feedback to augment internal timing representations. Method: Fifty four children (21 typically developing and 33 dyslexic) performed a dual motor task (clapping while walking) alone and with a metronome signal for 16 trials. They were then divided into sub-groups based on their MABC scores. Stability measures included interclap (ICI) and interheel strike (IHI) intervals across trial blocks. Consistency measures included coefficient of variation of ICI/IHI. Results: Children with co-existing DCD and dyslexia statistically differed from other groups in ICI and IHI period stability. Further, differences existed in from pre to post test in IHI for DCD (.03) and DCD at risk (.036) groups, and in ICI for DCD at risk ($p = .0002$). In terms of temporal consistency, group differences existed in ICI ($p = .001$); post hoc tests revealed the DCD group differed from others. Dyslexic groups not at risk for DCD differed between pre and post test on ICI. In IHI, no group differences existed, and two dyslexic groups (> 30%tile of MABC and at risk for DCD) changed from pre to post test. These results suggest that the ability to stabilize both arm and leg period across trials may be aided by using an auditory pacing signal. At the same time, a short-term auditory pacing intervention does not seem to improve temporal consistency within a trial in individuals with DCD and coexisting DCD.

Sport and Exercise Psychology

Title: Special measurement issues in sport and exercise psychology

Organizer: Nicholas D. Myers, University of Miami

Special measurement issues in sport and exercise psychology

Myers, Nicholas D., University of Miami

Measurement in sport and exercise psychology is a complex and rapidly evolving area of research that draws upon both psychological theory and methodological advances. Because measurement in sport and exercise psychology is multidisciplinary by nature, the team assembled for this symposium includes scholars in measurement sport and exercise psychology in particular, and, scholars in educational and psychological measurement more generally. The purpose of this symposium is to present three complex measurement issues of special interest within sport and exercise psychology. The discussant will open the symposium by providing an overview of a recently published comprehensive textbook on measurement in sport and exercise psychology in order to provide a coherent framework within which each presentation will be situated. Each presentation will then follow a substantive-methodological synergy format. First, a complex measurement methodology will be introduced in a general way. Methodological topics will include multilevel differential item functioning, exploratory structural equation modeling under target rotation, and meta-analysis of measurement outcomes. Second, a complex measurement methodology

will be didactically applied to an important substantive measurement issue within sport and exercise psychology. Substantive topics will include parent and examiner ratings of children's social-emotional skills, referee self-efficacy, and goal orientation and negative affect in physical activity. Third, other potential applications of a complex measurement methodology within sport and exercise psychology will be presented. The discussant will then summarize how both the substance, and the methodology, of each presentation may contribute to the future of measurement in sport and exercise psychology.

Special measurement issues in sport and exercise psychology—Gender invariance from a multilevel perspective in ratings of play and peer skills within a social-emotional domain

French, Brian F.; Ullrich-French, Sarah C.; Washington State University

This study applies a new psychometric development within the sport and exercise psychology area. We examine gender item invariance with parent and examiner ratings of children's social-emotional skills on the Early Inventory of Development-III (IED-III), with a focus on the Play and Peers items (e.g., plays cooperatively in group). Social-emotional skills include a child's ability to express and regulate emotions in a socially appropriate manner and form secure relationships (Center on the Social Emotional Foundations of Early Learning, 2008). National surveys indicate that teachers view social skills and regulatory behaviors as critical indicators of whether or not a child is adjusting well in school (e.g., Rimm-Kaufman et al., 2000). However, there could exist a gender stereotype in teacher expectations about student achievement in physical tasks (Chalabaev et al., in press), including ratings of physical competence (French & Manzicopolous, 2007). We introduce multilevel differential item functioning (MDIF; French & Finch, 2010) within the realm of play and peer behaviors. Differential item functioning (DIF) analysis allows for the assessment of group differences in item responses given an equivalent level of the latent trait being measured. However, DIF analyses conducted in the presence of multilevel data results in Type I error inflation (French & Finch). MDIF methods have been and are being developed to control for this inaccuracy. MDIF was applied to the IED-III employing the United States standardization sample ($N = 1100$; 50% female; age range 3-7 years) where sample demographics closely match the U.S. student demographics. The 50 items (3 response options) were rated by the caregiver or examiner where students were nested in childcare centers or schools. The results demonstrate differences in identified DIF items when statistical modeling accounts for and does not account for multilevel data across more than one method. Implications for rating peer and play skills are discussed.

Special measurement issues in sport and exercise psychology—Exploratory structural equation modeling under target rotation and referee self-efficacy

Myers, Nicholas D.; Jin, Ying; Ahn, Soyeon; Chase, Melissa A.; Miami University; Feltz, Deborah L., Michigan State University

The purpose of this study was to provide a substantive-methodological synergy of a special measurement issue in sport and exercise psychology. The substantive focus was to develop, and then to provide initial validity evidence for measures derived from, the Referee Self-Efficacy Scale (REFS). Referee self-efficacy ("refficacy") was conceptualized within self-efficacy theory (Bandura, 1997) and more specifically, self-efficacy in sport (Feltz, Short, & Sullivan, 2008). The methodological focus was to introduce

exploratory structural equation modeling (ESEM; Asparouhov & Muthén, 2009) under target rotation. ESEM is a methodology that integrates the advantages of exploratory factor analysis and confirmatory factor analysis (CFA) within the general structural equation model (SEM). Target rotation was designed to take advantage of extant, though incomplete, a priori measurement theory without the restriction of fixing parameters to specific values as in CFA (Browne, 2001). ESEM under target rotation may be the optimal framework when searching for a well-fitting measurement model with a close, but inexact, a priori measurment theory. ESEM under target rotation played a central role in the development of the REFS. Data were collected from referees (N = 1609) in the United States (n = 978) and Spain (n = 631). In Study 1 (n = 512), a single-group ESEM under target rotation provided evidence for four factors: game knowledge, decision-making, pressure, and communication. In Study 2 (n = 1153), multiple-group CFA models provided evidence for partial factorial invariance by country, level of competition, and team gender. In Study 3 (n = 456), potential sources of refficacy information combined to account for a moderate or large amount of variance in each dimension of refficacy with years of referee experience, highest level refereed, physical/mental preparation, and environmental comfort each exerting at least one statistically significant direct effect.

Special measurement issues in sport and exercise psychology—A new method for synthesizing studies from diverse measures: A re-analysis of Ntoumanis and Biddle (1999)'s meta-analysis

Ahn, Soyeon, University of Miami

The purpose of this presentation is to introduce an author-developed new method for synthesizing study findings measured by various scales. The existing methods for handling such an issue are practically limited, particularly when the variation in the validity of measures is apparent. Thus, a new method was proposed, which can be more applicable in practice. Our method was based on the idea of linking variables in primary studies to their constructs by applying a latent variable framework. Particularly, our method was derived from the measurement models that specify the direct relations of measures to the constructs with measurement errors being considered. Thus, not only is this method suitable for handling the differences in the relation of measures to the construct, but also it takes into account variation in measurement errors. Also, our method offers a mathematical framework that quantifies the relation between the constructs in the meta-analytic framework. In this presentation, our method will be described in details, and its application to a real data from sport and exercise psychology will be provided. A subset of 14 studies included in a published meta-analysis by Ntoumanis and Biddle (1999) was used, in which the relationship between goal orientation and negative affect in physical activity was examined. Goal orientation was measured by Task and Ego Orientation in Sport Questionnaire (k = 8), Perception of Success Questionnaire (k = 2), and Sport Orientation Questionnaire (k = 4). Measures for negative affect included Intrinsic Motivation Inventory (k = 8), Sport Competition Anxiety Test (k = 3), and Competitive State Anxiety Inventory-2 (k = 3). The estimated relation between task orientation and negative affect was -.09 with its variance of .0003, after dealing with differences in measurement errors and factor loadings. The 95% confidence interval of -.12 and -.06 indicates that the relation was statistically significant. Thus, the estimated magnitude using new method was lower than that of Ntoumanis and Biddle (1999).

Motor Learning and Control

Title: New advances in the quiet eye phenomenon from research in neuroscience, centre of pressure, and surgery

Organizer: Joan N. Vickers, University of Calgary

New advances in the quiet eye phenomenon from research in neuroscience, centre of pressure (COP), and surgery—Expertise differences in surgical movements, quiet eye duration, and performance during identification and dissection of the recurrent laryngeal nerve

Harvey, Adrian N.; Snelgrove, Ryan; Scott, Matt; Sheila, Morrison; Vickers, Joan N.; University of Calgary

The purpose of this study was to examine the surgical movements, quiet eye (QE) duration and performance of highly experienced (HE, > 200 operations, $n = 3$) and less experienced (LE, > 200 operations, $n = 7$) surgeons/residents during a thyroid lobectomy on a human cadaver model. The QE was defined as the final fixation prior to any surgical movement that may harm the patient (e.g., blunt or sharp dissection). Coupled gaze and motor data were collected in a cadaver model using the Mobile Eye. Surgeon performance was quantified by independent, blinded review of the video data with global rating scores for each of three phases: 1) identify inferior thyroid artery (ID ITA); 2) identify recurrent laryngeal nerve (ID RTN); and 3) divide ligament of Berry (Div LofB). HE performance was significantly higher than LE. HE took less time (%) to identify the RLN in the ID RLN phase, but longer in the Div LofB, a segment of the operation where the nerve is at greatest risk of injury. As predicted, QE durations were longer for HE compared to LE in the final two phases when the RLN was visible. HE surgeon's longer QE durations revealed the use of a greater focus of attention on the RLN, prior to executing surgical movements.

New advances in the quiet eye phenomenon from research in neuroscience, centre of pressure (COP), and surgery—Internal and external focus effects during quiet stance on the quiet eye and COP of elite ballet dancers and controls

Vickers, Joan N., University of Calgary; Panchuk, Derek, University of Australia; Ramage, Barb; Ronsky, Janet; Ferber, Reed; Morton, Barry; University of Calgary

We manipulated the attention of elite ballet dancers and controls externally (focus on the X), internally (focus on your feet) and during a preferred condition when no instructions were given while COP and gaze were measured. No group differences were found between the internal and preferred conditions but during the external condition the ballet group had greater A-P excursions, a longer quiet eye (QE) duration on the X, shorter fixation durations off the X and lower interfix angles, indicating a preference for maintaining fixation on one location at eye height. When a long duration QE was held on the X, A-P sway increased, predicting $R^2 = .23$ of variance in ballet sway and $R^2 = .09$ for control. When fixation deviated off the X sway decreased (ballet $R^2 = .25$ amd control $R^2 = .12$) indicating COP was affected by how long the QE duration was held on a critical location in far space.

New advances in the quiet eye phenomenon from research in neuroscience, centre of pressure (COP), and surgery--Methods for determining the neural mechanisms underpinning quiet eye

Causer, Joe; Williams, Mark; Liverpool John Moores University

In aiming tasks, the final fixation on a target before the initiation of action (quiet eye period; QE) has been shown to differentiate expertise and performance levels. A prolonged QE may permit task-salient cues to be prioritized so that cortical resources are likely reallocated away from irrelevant sensory cues and toward the visuospatially dominant processes critical for effective motor programming. However, the cognitive and neural mechanisms that underlie the behavior have seldom been systematically examined. Previous studies have reported an association between longer QE periods and pronounced hemispheric asymmetry. Specifically, greater right hemisphere activation and a quietening of the left hemisphere, implying a reduction in verbal analytical processing. These findings suggest that a relationship exists between the QE period and cerebral efficiency. Furthermore, using event-related potentials, systematic differences in QE duration and Bereitschaftspotential (BP) have been observed, with experts exhibiting a prolonged QE period and greater cortical activation in the right-central region compared to non-experts. To extend the knowledge of the neural mechanisms underpinning QE, other technologies should be explored. For example, transcranial magnetic stimulation (TMS) has been used in conjunction with functional magnetic resonance imaging (fMRI) to reveal both the interactivity and necessary role of different brain regions in human attentional control. Future QE studies should utilise these advanced neuroscientific procedures to elucidate the necessary role of different brain regions in QE behavior. These techniques can be used to examine the neural structures that are recruited under QE conditions. Furthermore, combining TMS with fMRI and eye movement recording can be used to test the necessary role of the different brain regions identified. This innovative approach using breakthrough technical advancements will have significant implications for neuroscience and augment QE research, as well as have a translational impact in real-world domains.

New advances in the quiet eye phenomenon from research in neuroscience, centre of pressure (COP), and surgery—Quiet eye, quiet head, quiet hand, or quiet heart: The four horsemen of human motor performance?

Wilson, Mark R.; University of Exeter; Cooke, Andrew M.; University of Birmingham; Vine, Samuel J.; University of Exeter; Moore, Lee J.; University of Exeter; Ring, Chris M.; University of Birmingham

Recent research has demonstrated that quiet eye (QE) training interventions provide a performance advantage over traditional, technique-focused interventions. However, the neural mechanisms by which the QE "works" are yet to be fully understood. The QE has been proposed to provide a period of quiescence prior to performance, allowing for the accurate and efficient response programming of movement. This talk discusses findings from two golf putting studies that may shed light upon, and initiate further research into, the underlying neural mechanisms related to psychomotor quiescence. First, 20 QE trained participants and 20 technique trained participants performed 360 training putts before completing retention and high-pressure conditions. QE trained participants revealed significantly greater psychophysiological quiescence (relatively longer QE periods and

greater deceleration of heart rate and forearm muscular activity) in the 3 s preceding the initiation of the putt, in comparison to their technique-trained counterparts. The QE trained group also displayed superior relative performance and movement control (reduced lateral and vertical clubhead acceleration) following training. While this study provides indirect evidence that QE training leads to a more efficient form of response-planning and motor control, research has yet to examine neural processes underpinning such effects. A recent EEG study in golf putting provides a useful starting point to explore such a general quiescence role. 10 expert and 10 novice golfers took 120 putts in low and high-pressure conditions, while EEG was recorded from 32 sites. Results revealed a reduction in EEG spectral power in frontal areas (across all bands) in the final seconds preceding putts. This effect tended to be stronger and begin earlier for experts and for putts that were holed. We postulate that QE training may help initiate such a general shut down of non-necessary processing, ensuring more efficient planning and control of movement. Future studies are planned to test this prediction.

Saturday, June 9

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Title: Sequence learning—An old problem revisited

Organizer: Jane E. Clark, University of Maryland

Sequence learning: An old problem revisited—Introduction

Clark, Jane E., University of Maryland

Sequential behavior is fundamental to action. From the simplest act of walking to the complexity of playing a Rachmaninoff piano concerto, all require the ordering and timing of actions. But how are these sequences learned and does this learning change developmentally? Although the "problem" of serial order in human action has long been known (Lashley, 1951), it has been understudied until recently. In this symposium, we focus on our current understanding about how we learn sequential actions. We begin by examining the nature of motor sequence learning: its cognitive, neural, and motor components. We then consider three important issues that influence sequence learning: sleep, working memory, and the nature of the sequence structure. Throughout and in summary we discuss our findings in light of their implications for sequence learning across the lifespan.

Sequence learning: An old problem revisited—Cognitive and neural contributions to motor sequence learning

Bo, Jin, Eastern Michigan University

Learning sequences is an essential component of human behaviors such as speech, playing musical instruments, and driving a car. Cognitive processes are a fundamental aspect of learning these motor sequences. This type of learning can be either explicit, where participants are aware of the sequence and the goal of learning, or implicit, where learning occurs outside of conscious awareness. It has been shown that varying the spatial versus symbolic nature of stimulus presentation and response production, which affects stimulus–response (S–R) mapping requirements, influences the magnitude of implicit sequence learning (Koch & Hoffman, 2000). In a series of experiments (Bo & Seidler, 2010), we examined the effects of age and spatial processing on implicit sequence learning using an alternating serial reaction time task (ASRT) in which spatial processing demands were either present or absent from stimulus presentation (spatial vs. symbolic cueing) and/or response execution (spatial manual vs. vocal responses). Results showed that implicit sequence learning depends on both the structure of response execution and relative task difficulty. In a following fMRI study (Bo et al., 2011), we tested a hypothesis that the dorsolateral prefrontal cortex (DLPFC) was preferentially engaged for spatially cued sequence learning and cerebellum was associated with symbolically cued learning. Results showed that the left cerebellum lobule HVI was selectively recruited for symbolic learning and the percent signal change in this region was correlated with learning magnitude under the symbolic conditions. In contrast, the DLPFC did not exhibit selective activation for learning under spatial conditions. Our findings reveal different brain networks that are flexibly engaged depending on the conditions of sequence learning.

Sequence learning: An old problem revisited—What about the "motor" in motor sequence learning?

Clark, Jane E., University of Maryland

Motor sequence learning has been well studied in tasks requiring finger or hand movements. However, a vast majority of motor sequence learning in every day activities involves whole body actions that present postural and inertial challenges not found in the fine motor tasks usually employed. In a series of experiments, we have explored "gross" motor sequence learning as children and adults practice a 10-element bilateral foot sequence with their actions recorded by a motion capture system. While both children and adults learn the sequence as measured by their improving reaction times (Valentini et al., 2012), we found age-related differences in how they managed the motion control requirements of the task. Indeed in an experiment in which we simply asked participants to repeatedly tap their feet, we found laterality differences in the way the center of mass was controlled (Kim et al., 2011). In another approach to disentangling the motor contributions to sequence learning, we studied two groups of "sequence experts" with different effector expertise, piano players and dancers, as they learned the 12-element sequence with either their hands or feet before transferring to the other effector. When compared to "novice" adults, the sequence experts were better regardless of effector used. Analysis of the experts revealed that they enjoyed an effector advantage. Our findings suggest that learning "motor" sequence tasks that involve the whole body while sharing similar underlying cognitive mechanisms of sequence learning offer their own unique challenges that may affect performers differentially, particularly for children and those with movement difficulties.

Sequence learning: An old problem revisited—Sleep protects against interference to motor sequence learning

Caldwell, Rhonda; Bo, Jin; Eastern Michigan University

The acquisition of a new motor skill normally relies on several phases of learning, including a fast early learning stage, a slow later stage, consolidation, automaticity and retention (Doyon et al. 2003; Doyon et al., 2011). Typically, early learning improvement can be observed within single learning session, and later time-dependent improvement occurs across sessions. The latter process can be considered as the consolidation phase where the learned skill becomes resistant to interference. Sleep has been known to play a vital role in memory consolidation for motor sequence learning. Early studies (Stickgold, 2005; Walker et al., 2003) have demonstrated clear sleep-dependent gains in motor learning. Later studies (Cai & Rickard 2009; Rickard et al., 2008), however, have showed that the such learning "gains" were due to several confounds such as circadian and time-of-day effects, leading to the idea that sleep does not enhance learning. But sleep could also protect against interference to motor sequence learning. The interference introduced after normal nocturnal sleep may not have a negative effect on learning whereas interference introduced prior to normal nocturnal sleep may result in less off-line gains in performance. The results from our work and that of others will be discussed for their practical implications for motor learning and rehabilitation.

Sequence learning: An old problem revisited—Implicit motor sequence learning and working memory capacity in typically developing children

Colbert, Alison; Chase, Adam; Bo, Jin, Eastern Michigan University

The ability to integrate individual movements into complex action is an important developmental achievement, and recent research has highlighted the possible contribution of motor learning deficits in developmental disorders (Barnhart et al., 2005; Mostofsky & Ewen, 2011; Westendorp et al., 2011). Unfortunately, the developmental patterns of motor skill learning and related cognitive processes are unclear, and controversial results have been reported regarding the development of implicit learning in childhood (Meulemans et al., 1998; Reber, 1993; Thomas et al., 2004). This leads us to question the underlying processes involved in the development of implicit motor sequence learning. It has been suggested that, though subconscious, working memory (WM) capacity plays a significant role in motor learning. For example, Bo et al. (in press), provided evidence suggesting that there is a significant contribution of WM in implicit sequence learning. A relationship between working memory capacity and implicit motor learning suggests interventions aimed at increasing WM could increase implicit motor learning ability, and reduce adverse outcomes associated with motor learning deficits. To date, few studies have been published specifically examining implicit sequence learning in young children. This led us to examine the contribution of WM to implicit motor learning in typically developing (TD) children and children with motor difficulties ages 7 to 12 years performing a serial reaction time task and computerized verbal and visuo-spatial working memory tasks. Understanding the relationship of working memory to motor sequence learning is critical to understanding the performance of TD children and to understanding these relationships in children with motor difficulties such as Autism Spectrum Disorders.

Sequence learning: An old problem revisited—Learning a sequence or learning to learn a sequence

Du, Yue, University of Maryland

How is a sequence learned? And what is learned from this sequence? Research findings suggest that people can learn simple-structured sequences by either statistical computation (deterministic probability-structured) or chunking (segmental-structured) (Perruchet & Paction, 2006). However, these local learning effects do not transfer to other sequences (DeCoster & O'Mally, 2011). Indeed, these two learning strategies might not be optimal for complex sequences with non-obvious probabilistic or repeating segmental structures. It may be possible that, besides chunks and conditional probability, there are hidden but more generalized statistical/mathematical functions governing the sequence structures. Learning these more generalized functions based on the specified sample motor sequences suggests that more generalized learning, or "learning to learn" is occurring. This assumes that if people learn a sequence and translate this into their performance, the performance would share the same functional properties as the sequential stimuli. In our studies of sequence learning across the life span and with experts and novices, we examine the statistical/mathematical structures of RT time series in a foot stepping and hand tapping tasks with six differently located targets. Results from the mean reaction time data show sequence learning; however, different structural patterns emerged. For example, we found RT time series structures differed across age groups. The adults' shared the most similar structure with the sequential stimuli, while the children's structure, especially the 6-year-olds', did not. The results suggest that the children's reduction in their RT performance with practice may result from alternative strategies, such as chunking sequence segments, rather than learning the whole sequence. Our findings thus far for different ages and different levels of expertise provide us with a number of future directions in understanding the development trajectories of the underlying mechanisms of motor sequence learning.

Sport and Exercise Psychology

Title: Understanding physical activity behavior both across the lifespan and in clinical populations

Organizer: Claudio R. Nigg, University of Hawai'i

Understanding physical activity behavior both across the lifespan and in clinical populations: Implications for theory and intervention—Motivational regulations relate to change in physical activity behavior among breast cancer survivors

Brunet, Jennifer, University of Montreal; O'Loughlin, Jennifer L., University of Montreal; Wrosch, Carsten, Concordia University; Sabiston, Catherine M., McGill University

Few breast cancer survivors (BCS) achieve the recommended physical activity (PA) levels needed to derive health benefits. Grounded in self-determination theory (SDT; Deci & Ryan, 1985), the objective of this prospective study were to (1) describe BCS' motivational regulations for PA shortly after completing treatment, and (2) examine the associations between these regulations and change in PA over a 6-month period. Participants included 199 BCS (mean age = 55.0 years, *SD* = 10.9) who completed self-report questionnaires and wore an accelerometer for 7 days within 5 months of completing treatment, as well as 3 and 6 months later. At baseline, participants reported low levels of external (mean = .44, *SD* = .61) and introjected (mean = 1.14, *SD* = 1.04) regulations, and moderate levels of identified (mean 2.63, *SD* = .91) and intrinsic (mean = 2.55, *SD* = 1.16) regulations, relative to the scale range (i.e., 0-4). Multilevel modeling analyses indicated significant changes in PA over the 6-month period, as indicated by a significant linear of time effect [*B* = 2810.57, *SE* = 239.38]. Moreover, a quadratic trend was observed [*B* = -937.30, *SE* = 106.57], where increases in PA were initially seen followed by decreases. Baseline external regulation was inversely related to change in PA [*B* = -19.21, *SE* = 8.71], whereas intrinsic regulation was positively related to change in PA [*B* = 16.83, *SE* = 6.56]. However, the association between baseline intrinsic regulation and PA weakened over time. Findings support the utility of adopting SDT when examining patterns of change in PA in BCS. Furthermore, they suggest promoting environments that foster intrinsic regulation, and decrease external regulation, may be one way to increase PA levels in this population. This study was funded by the Canadian Institutes of Health Research. The first author is supported by a HSFC Research Fellowship and a PORT postdoctoral award.

Understanding physical activity behavior both across the lifespan and in clinical populations: Implications for theory and intervention—Dual mode theory: Does it apply to interval exercise?

Jung, Mary E.; Wright, Amy E.; Wright, Wendi L.; Carson, Demian C.; University of British Columbia Okanagan; Gurd, Brendon J.; Little, Jonathan P.; Queen's University

The acute affective response to exercise influences future exercise behavior (Williams et al. 2008), thus lending support for the dual mode theory (DMT; Ekkekakis, 2005) in the context of exercise adherence. DMT suggests that exercise above the aneorobic threshold (AT) results in negative affect, with consequences of lower enjoyment and future exercise engagement. Physical activity guidelines now encourage low-to-moderate- over vigorous-

intensity exercise, with suggestions that lighter-intensity exercise is better tolerated and will thus promote greater long-term adherence. Research supporting the DMT has only been conducted on continuous exercise, such as cycling for 30-60 min. Low-volume, high-intensity interval training (HIT) promotes similar health benefits as continuous moderate-intensity exercise in significantly less time (Gibala, 2007). A bout of HIT consists of brief intervals of vigorous exercise interspersed with short rest periods. The rest periods and decreased time commitment may make HIT more attractive than continuous moderate-intensity exercise despite the intervals being performed above the AT. Using DMT as the theoretical framework, we have recently conducted a series of studies in various samples (healthy university students, sedentary adults, individuals with prediabetes and type 2 diabetes) to assess the affective response, and overall tolerability, of HIT compared to continuous moderate- and vigorous-intensity exercise. We are consistently demonstrating that vigorous exercise, when performed in an interval fashion, elicits more positive affect and greater ratings of perceived enjoyment as compared to continuous vigorous-intensity exercise. Interestingly, regardless of in-task affective responses, when asked to choose which modality of exercise participants would prefer most, the majority of individuals choose HIT over continuous vigorous- or moderate-intensity exercise. Based on our cumulative data, the tolerability of interval exercise, and the potential adherence to HIT, in healthy and chronic disease populations will be discussed.

Understanding physical activity behavior both across the lifespan and in clinical populations: Implications for theory and intervention

Nigg, Claudio R., University of Hawai'i; Resnicow, Ken, University of Michigan

In spite of numerous efforts to better understand physical activity (PA) behavior in the United States and Canada, at least half of these populations fail to engage in PA levels necessary to optimize health benefits. PA levels tend to decrease during childhood and adolescence, and are lower among most clinical compared to "healthy" populations. Innovative and theoretically guided research has informed sport and exercise psychology intervention strategies. The purpose of this symposium is to present different theoretical frameworks used to understand PA behavior in a variety of samples (e.g., youth, adults, and chronic disease) and discuss the practical usefulness of these frameworks in designing and implementing intervention strategies. In the first presentation, different environmental conceptualizations are investigated within a social cognitive framework in efforts to further understand this dimension in predicting children's physical activity. In the second presentation, a series of studies will be presented to present and challenge the dual mode theory. Specifically, high-intensity intermittent (compared to continuous) PA may have unique benefits and could be practically useful for many inactive individuals. In the third presentation, organismic integration theory is used as a guiding framework to better understand PA among breast cancer survivors in a prospective longitudinal study. Also, the theoretical implications for PA assessed via self-report versus accelerometer will be presented. Following the presentations, a discussion will challenge theoretical research as foundational to intervention strategies, provide perspectives on recurring and novel issues to understanding PA behavior in various populations, and offer suggestions for advancing the research agenda in sport and exercise psychology.

Understanding physical activity behavior both across the lifespan and in clinical populations: Implications for theory and intervention—How we conceptualize perceived physical activity environment for children matters

Nigg, Claudio R.; Anwar, Mahabub-Ul.; Amato, Katie R.; Steffen, Alana D., University of Hawai'i; Kutchman, Eve; University of Colorado Denver; Browning, Raymond C.; Colorado State University

The data is equivocal whether perceived physical activity (PA) environment influences children's PA. Therefore, we investigated how conceptualizations (presence and condition of playground structures and how often there is equipment/supervision) of the perceived PA environment differentially explained children's moderate and vigorous PA above and beyond psychosocial predictors. Children in Denver, CO (grades = 4th-5th; $n = 393$; mean age = 10.25 [±.76]; 50.38% female; 57.91% Hispanic, 27.35% White, 14.75% other) were administered surveys. Overall, mean self-efficacy (range:1-5) was 3.27±0.80, Cronbach's $\alpha = .66$; social support (0-8) was 6.22±1.54, Cronbach's $\alpha = .56$; and PA enjoyment (1-5) was 4.35±0.70, Cronbach's $\alpha = .81$. Gender, ethnicity, age and psychosocial variables were controlled. Model 1 revealed that these variables explained 24% of PA ($F(7, 345) = 15.44$, $p < .05$). Psychosocial variables significantly predicted PA (self-efficacy beta = .24, $p < .05$; social support beta = .24, $p < .05$; PA enjoyment beta = .15, $p = .05$). Presence and condition of play structures (e.g., swings) explained an additional, non-significant .88% of PA ($F(2,343) = 1.99$, $p > .05$). In Model 2, perceptions of equipment/supervised environment were how often schools provide adult supervised recess/lunch and afterschool PA, allow weekend use of play areas, and provide equipment (e.g., balls) during recess/lunch and after school. Model 2 included only children who responded to all these variables; they were not demographically different from those who were excluded ($p > .05$). Demographic and psychosocial predictors explained 19% of PA ($F(7, 188) = 6.11$, $p < .05$). All psychosocial variables were significant predictors (self-efficacy beta = .18, $p < .05$; social support beta = .17, $p < .05$; enjoyment beta = .15, $p = .05$). The perceptions of equipment/supervised environment explained an additional 6.24% of PA ($F(5,183) = 3.04$, $p < .05$). Our results indicate that the conceptualizations of the PA environment matters and that providing equipment and supervision is more important in predicting children's PA than playground structures.

Title: Exercise and cognitive function—Current evidence

Organizer: Yu-Kai Chang, Graduate Institute of Coaching Science

Exercise and cognitive function: Current evidence

Chang, Yu-Kai, Graduate Institute of Coaching Science

Recently, issues of exercise and cognition have been drawing much attention and the research has been conducted using a variety of experimental designs. Based upon several meta-analytic reviews, previous literature generally supports that both acute and chronic exercises are beneficial to cognition; however, the majority of studies have merely emphasized the aerobic exercise modality, a few aspects of executive functions, and cognition modification following immediately cessation of exercise. In addition, most research has targeted effects either during or after exercise, as well as diverse populations that should be considered differently according to physical and mental conditions and characteristics.

The purpose of this present symposium attempts to advance our understanding by addressing the previous research gaps and current findings between exercise and cognition. The first and second presentations provide overviews of exercise and cognition research and specifically present advanced findings related to acute exercise and cognition in terms of exercise modality, time course, and the planning aspect of executive functions. The third presentation examines the fluctuations of executive functions during exercise. Finally, the forth presentation shifts attention to the effects of chronic exercise on cognition, using different exercise modalities, as assessed by neuroelectronic measurements in elderly adults. These researches have demonstrated that issues of exercise and cognition have been examined employing diverse approaches and that the current evidences supports that both acute and chronic exercise could be used as effective approaches to facilitating cognition. Further research regarding examining mechanisms, applying neuropsychological assessments and neuroelectronic techniques for determining the effects of exercise on cognition is recommended.

Exercise and cognitive function: Current evidence. Planning following acute resistance exercise in late middle-aged adults—A study with the Tower of London

Chang, Yu-Kai, Graduate Institute of Coaching Science; Wang, Chun-Chih; Chen, Feng-Tzu; Su, Ting-Yi; National Taiwan Sport University

Considerable research has investigated the issue of how acute exercise affects cognition; however, the majority of studies have generally emphasized an aerobic exercise modality, and the inhibition aspect of executive functions, as well as targeting younger and older populations. The present study attempts to further our understanding by investigating the effects of an acute bout of resistance exercise on the planning aspect of executive functions in late middle-aged adults. Using a within-subjects design, thirty community-dwelling adults (mean age = 57.20±2.93 years, 16 female) experienced both resistance exercise and control treatment conditions as well as conducting planning related cognitive tasks. The exercise conditions involved 2 sets of 70% of 10 repetition maximal at seven exercises, while control conditions consisted of a similar duration of the exercise condition of reading. Planning was determined by the Tower of London (TOL) and was assessed prior to and immediately after each treatment. The results indicated that facilitative effects in terms of lower total move scores, more total correct scores, and longer total initial time following acute resistance exercise were revealed when compared to control and pre-conditions. This study has demonstrated that acute resistance exercise had positive impacts on planning assessed by the TOL in late middle-aged adults, and additionally supports the idea that the use of an acute resistance exercise regimen could contribute to improving the subjects' quality of planning, working memory, and inhibition of the TOL.

Exercise and cognitive function: Current evidence—The immediate and sustained effects of acute exercise on the planning aspect of executive functions

Chen, Feng-Tzu; Wang, Chun-Chih; Lee, Pei-Ching; Chu, Chien-Heng; Chang, Yu-Kai; National Taiwan Sport University

Extensive research has investigated the effects of acute exercise on cognition; however, the issues of planning aspect of executive functions, as well as the related time course, have been incompletely examined. The purpose of this study was an attempt to clarify the immediate and sustained effects of an acute bout of exercise on planning. Forty college-

aged participants were randomly assigned into either exercise or control groups and were administrated the Tower of London Task prior to exercise, immediately following, 30 min, and 60 min after cessation of a 30-min cycling exercise with moderate intensity. The results indicated that acute exercise positively impacts total move scores that reflect planning efficiency immediately after termination of the exercise. Acute exercise also leads to longer total initiation time that links to better response inhibition of planning, at 30 min and 60 min, following cessation of exercise. In conclusion, acute exercise benefits the planning, while types of planning and time points assessed may moderate acute exercise and executive functions. Exercise-induced physiological and biological fluctuations have been proposed to explain the immediately after exercise effect and the mechanism of sustained exercise effect is worth further exploration.

Exercise and cognitive function: Current evidence—The effect of the Wisconsin Card Sorting Test during different intensities of acute exercise

Wang, Chun-Chih, National Taiwan Sport University; Chi, Lin, Ta Hwa Institute of Technology; Kong, Hsiao-Fang; Yang, Kao-Teng; Chang, Yu-Kai; National Taiwan Sport University

The purpose of this study was to investigate the influence of the Wisconsin Card Sorting Test during acute aerobic exercise with different intensities. Eighty participants were recruited and randomly assigned into control, low (30% heart rate reserve, HRR), moderate (50% HRR), and high exercise intensity (80% HRR) groups. The participants were instructed to perform the Wisconsin Card Sorting Test during different exercise settings. The indices of the Wisconsin Card Sorting Test included perseverative errors, nonperseverative errors, number of categories completed, percent conceptual level responses, and failure to maintain set. These indices implicate working memory, problem solving, and attention. Results form one-way analysis of variance revealed that perseverative errors, nonperseverative errors, number of categories completed, and percent conceptual level responses were significantly decreased in the high exercise intensity group, while no differences were found in the low and moderate exercise groups. However, none of these differences among all exercise intensity groups were found on the failure to maintain set. In conclusion, working memory and problem solving were impaired during high exercise intensity setting; nevertheless, they were unaffected during low and moderate exercise intensity settings. Additionally, attention was not affected among all exercise groups. Future research might encourage focus on the influences of differ types of executive functions during exercise in order to further our understanding.

Exercise and cognitive function: Current evidence—Do different types of exercise affect the cognitive function in elderly?

Lin, Jung-Huei, National Ilan University; Lin, Peng-Chun, Taipei Municipal University; Chen, Huei-Ying, Chang Gung University of science and Technology; Hung, Tsung-Min, National Taiwan Normal University

Regular participation in physical activity appears to attenuate the decline of cognitive function observed in the elder population. However, what type of physical activity that is more beneficial for preserving cognitive abilities in aging is still unclear. As such, the purpose of this study was to investigate the effect of different types of exercise on cognitive function of the elderly. Sixty elder people (23 men and 37 women) aged 65-75 years were

recruited, and further divided into three groups according to the types of exercise, open skill group (e.g., tennis, table tennis, and badminton), closed skill group (e.g., jogging, swimming), and control group (e.g., sedentary lifestyle). P300 was elicited by the Flanker task and reaction time, amplitude, and latency of P300 were recorded. The cognitive challenge of the Flanker task is that, comparing to the congruent condition, the response to the misleading flankers in the incongruent condition must be inhibited or filtered to make a correct response (Botvinick et al., 1999). Furthermore, successful inhibition of the misleading information is signified by shorter reaction time to the incongruent cues. Results showed that, comparing to the control group, the open skills group had shorter reaction time in both the congruent and incongruent conditions of the franker task. Nevertheless, no significant differences of the P300 amplitude and latency have been found among these groups. These findings indicated that participants who exercise, in open skill sports in particular, at regular basis performed better on parts of cognitive performance than sedentary lifestyle participants did.

Motor Learning and Control

Title: Talent and Expertise—Filling knowledge gaps in understanding elite athlete development

Organizer: Clare MacMahon, Victoria University

Talent and Expertise: Filling knowledge gaps in understanding elite athlete development

Weissensteiner, Juanita, Australian Institute of Sport; MacMahon, Clare, Victoria University

Although it has fascinated researchers for decades, research examining the identification and development of sporting talent has only benefitted from structured and systematic programmes of research in the past 15 years. These more recent concentrations of effort have allowed a greater focus on the "gray" areas of development including socio-contextual and developmental factors, and a more fine-tuned understanding of the micro-components of development. In addition, structured programmes supporting talent development provide accessible "living laboratories" that can now be studied with greater control. This symposium presents current research specific to talent identification and development in sport, featuring different research designs and foci. It will introduce an integrated model of sport and talent development, the FTEM representing the 'whole of sport' continuum and highlighting factors thought to be instrumental in athlete developmental progression from recreational participant to sporting master; feature the findings of a comprehensive online questionnaire, the DHAQ examining the sporting investment and familial involvement of athletes across the developmental spectrum from different countries and sports; present research examining potential barriers and facilitators of the junior to senior transition in the sport of tennis and finally provide an in-depth analysis of the developmental experiences of successful and non-successful talent detection athletes within a structured flatwater canoeing program. Implications for future research and practice specific to the identification and development of sporting talent will be presented and discussed.

Talent and expertise: Following in their footsteps?—Sport expertise and parental participation in sport and physical activity

Hopwood, Melissa, Victoria University; MacMahon, Clare, Victoria University; Baker, Joseph, York University; Farrow, Damian, Australian Institute of Sport

The family has been identified as a critical influence on sport expertise development, with much of the research in this area focusing on the provision of resources and the changing roles of the family throughout athletes' careers. Although associations between parent's and children's participation in physical activity have been explored, little is known about the associations between parent participation in sport and physical activity and the development of sport expertise. As part of a larger investigation of sport expertise development, patterns of participation in sport and physical activity were examined for the parents of 229 athletes from Australia and Canada (mean age = 23.28 ± 4.79) via completion of the Developmental History of Athletes Questionnaire. Athletes represented 36 different sports and three skill levels—nonelite, pre-elite, and elite. Pearson chi-square tests for independence revealed significant associations between skill level and parental involvement in general fitness activities, recreational sport, and competitive sport, with parents of elite athletes participating in these activities more regularly than parents of nonelite athletes. Specifically, involvement of the mother in general fitness activities and recreational sport, and involvement of the father in competitive sport were most strongly associated with athlete skill level. Additionally, parents of elite athletes were also more likely to have competed at the elite levels of competition themselves ($\chi^2(6) = 17.04$, $p < .01$), but not necessarily in the same sport as their child. These results support previous research highlighting the importance of the family for the development of sport expertise, and extend current knowledge in this area by suggesting that parent modelling of physical activity behaviors and parent participation in high performance sport may influence athlete development.

Talent and expertise: Examining the barriers and facilitators of the junior to senior transition experience in Australian tennis—An in-depth analysis of the journey towards a professional tennis career

Matthews, Alicia, Australian Institute of Sport/Victoria University; Farrow, Damian, Australian Institute of Sport/Victoria University; MacMahon, Clare, Victoria University; Weissensteiner, Juanita, Australian Institute of Sport

Within the elite sporting experience, successful transitioning between key points in an athlete's career appears critical (Pearson & Petitpas, 1990). Specifically in the sport of tennis, successful negotiation of the transition from junior to senior competition underpins a successful professional tennis career. Whilst a great deal of anecdotal evidence exists (Dewhurst, 2007; Draper, 2011), there is scant empirical evidence detailing the factors which facilitate or constrain a successful transition from junior to senior professional tennis. In order to maximise current and future talent development, an examination of why some elite junior athletes do not make the transition to a successful professional tennis career (i.e., Top 100 ATP ranking) is warranted. Utilising evidence sourced from interviews with past elite Australian players (Top 100 ATP ranked athletes and those with an ATP ranking greater than 100) key factors and characteristics that influenced their developmental pathways and transition were explored. Interview data were analysed using methods compatible with grounded theory (Strauss & Corbin, 1998) and developmental milestone data was analysed statistically using SPSS software (Version 15). Preliminary data revealed that

being a Top 100 ATP player required a favourable mix of psychological characteristics as well extrinsic factors related to organisational support. Final findings will be presented in the form of a full conceptual model highlighting the interaction of emergent intrinsic and extrinsic factors that contribute to the transition experience and ultimately attainment of Top 100 ATP ranking. Information gained from this investigation will be utilised to inform and refine current and future developmental practices, resource and support provision and policy specific to the sport of tennis.

Talent and expertise: Well hello, sailor! Navigating the developmental archipelago—How to avoid running aground

Gulbin, Jason, Australian Institute of Sport

Our understanding of the holistic process of athlete development is largely poor. While researchers have established various sub-components that can affect the developmental outcome, holistic conceptual or empirically tested models lack sufficient pathway transition elements to provide a really useful navigational tool for sporting stakeholders. To this end, a new athlete pathway framework (FTEM) has been developed, based on a complementary inductive/deductive research approach which utilises theoretical underpinnings as well as real-life observations and accrued experiences (Smith, 2010). The FTEM framework aims to provide a far greater level of differentiation with respect to the developmental process. The framework consists of 4 macro phases and 10 micro phases and considers their influence on the participant experience relative to the "3 worlds" (i.e., an active lifestyle, sport, and sporting excellence - Bailey et al., 2010). The key elements of the FTEM framework include: Foundations (F1, F2 and F3); Talent (T1, T2, T3 and T4); Elite (E1 and E2); and Mastery (M). This presentation will introduce the FTEM framework and will discuss its theoretical and practical implications for those sporting stakeholders interested in both system and individual outcomes.

Talent and expertise: To be or not to be—An investigation into the factors affecting the development of athletes who have been identified through talent detection

Morley, Elissa, Australian Institute of Sport/Victoria University; Gulbin, Jason, Australian Institute of Sport; Weissensteiner, Juanita, Australian Institute of Sport; MacMahon, Clare, Victoria University

The identification and development of talent for high performance sport is a complex and widely discussed issue. Athletes are typically identified from within the sport of interest (talent selection), and less commonly identified from outside the sport (talent detection) (Vaeyens, Lenoir, Williams & Philippaerts, 2008; Williams & Reilly, 2000). Despite the opportunities and efficiencies that talent detection can provide (Bullock, Gulbin, Martin, Ross, Holland & Marino, 2009), processes underpinning the identification and development of talent detection athletes and the viability of systemic talent detection programs have received modest attention within the scientific literature. Therefore, the aim of this study was to examine the characteristics of a successful talent detection program and to investigate why some talent detection athletes transition successfully into high performance sport, while others do not. A case study approach was adopted using flatwater kayakers detected through the Australian National Talent Identification and Development Program. Athletes were matched in pairs based on age, gender, sporting history, kayaking commencement date, training environment, and physical and physiological capacity. The key

differentiating factor within each pair of athletes was their highest level of achievement in kayaking with one athlete reaching Australian team representation and the corresponding pair-matched athlete not progressing to the international level. Athletes and their coaches participated in semi-structured interviews and retrospective kayaking performance and physical testing data was used to complement interview findings. Procedures specific to thematic analysis were adopted to analyse the interview data while performance and testing data was analysed using the statistical package SPSS (version 17). Major themes relating to factors that facilitated and constrained the success of talent detected flatwater kayakers will be presented. Discussion will focus on concepts and recommendations to improve talent identification and development practices.

Developmental Perspectives: Motor Control/Coordination/ Rehabilitation

Title: Auditory-motor synchronization in sports, the arts, and rehabilitation

Organizer: Melvyn Roerdink, VU University Amsterdam

Auditory-motor synchronization in sports, the arts, and rehabilitation

Roerdink, Melvyn, VU University Amsterdam

Rhythmic bodily movements are more or less automatically attracted to external acoustic rhythms. Acoustic rhythms may thus be exploited to modulate rhythmic movements such as the movement frequency by changing the beats per minute of the acoustic rhythm. A key sports example of this modulation is spinning, where the beats per minute of the music determine the cyclists' revolutions per minute. This symposium focuses on the application of basic principles, theories, and concepts of rhythmic auditory-motor synchronization to enhance sports performance, artistic expression, and rehabilitation practice. Regarding sports performance, the time to exhaustion is known to increase when running to synchronous music, but it is unclear whether this is attributable to auditory-motor synchronization or to other beneficial aspects of music (e.g., motivation). With respect to the arts, coordination to the musical beat is essential for elegant artistic dance performance, and careful examination of the stability of auditory-motor coordination may tentatively assist in unraveling determinants of skilful dancers. In rehabilitation practice, entrainment to acoustic rhythms is often utilized to influence cadence, symmetry and fluency of pathological gait, but it is unclear how those rhythms are best configured to yield optimal results. In this symposium we will answer these questions by translating basic motor control insights on auditory-motor synchronization to sports, the arts, and rehabilitation.

Auditory-motor synchronization in sports, the arts, and rehabilitation. Paper 1: Auditory-motor synchronization to enhance sports performance: Coupling Gebrselassie to Scatman to beat a world record!

Bood, Robert Jan; Nijssen, Marijn; van der Kamp, John; Roerdink, Melvyn; VU University Amsterdam

In 1998, the Ethiopian athlete Gebrselassie astonished the world by breaking the 2000-m indoor world record. After his race, he claimed that he adjusted his pace to the song

Scatman, which was played throughout the race. The coupling of cadence to an acoustic rhythm (i.e., auditory-motor synchronization) may be beneficial for sports performance [1]. However, music also has motivational qualities with proven beneficial performance effects [2]. Our goal was to single out the effect of auditory-motor synchronization per se on running performance by instructing 19 participants to run to exhaustion on a treadmill in 1) a control condition without music, 2) a music condition with synchronous motivational music attuned to participants' cadence and 3) a metronome condition with a sequence of beeps matching participants' cadence. Conditions were counterbalanced and performed on separate days. Heart rate and rating of perceived exertion did not differ between conditions, indicating that participants ran to exhaustion in all conditions. Interestingly, the time to exhaustion differed significantly between conditions; time to exhaustion was longer with than without acoustic stimulation, regardless of its nature (metronome: 19.6%, music: 17.5%). Comparable effects were recently reported for elite triathletes instructed to run to self-selected synchronous motivational music, a synchronous neutral equivalent and a control condition without music; time to exhaustion was longer with than without music, regardless of its motivational quality [3]. In combination, these results suggest that the motivational qualities of music may be less important than the prominence of its beat, allowing participants to synchronize their pace to the prescribed tempo of the acoustic beat. This may help maintaining a high pace and thus running speed required to beat a world record. [1] Simpson SD, Karageorghis CI. J Sports Sci 2006; 24:1095-102 [2] Karageorghis CI, Terry PC, Lane AM. J Sports Sci 1999; 17:713-24 [3] Terry PC, Karageorghis CI, Saha AM, D'Auria S. J Sci Med Sport 2012; 15:52-7.

Auditory-motor synchronization in sports, the arts, and rehabilitation. Paper 2: Relative phase dynamics in auditory-motor coordination—Towards perceptual support for artistic performance

Kudo, Kazutoshi, University of Tokyo; Miura, Akito; Fujii, Shinya; University of Tokyo & Japan Society for the Promotion of Science

Among a variety of dance styles, street dance has a salient feature in that almost all the musical beats are synchronized by the dancers' movements, requiring whole-body auditory-motor synchronization. Recently, two distinguishable stable coordination modes in basic street-dance exercise were identified: up (knee extension) and down (knee flexion) movement to the beat [1]. In that study, participants were required to synchronize their knee extension or flexion to metronome beats in a standing position for a range of metronome frequencies. An unintentional phase transition occurred in terms of relative coordination between metronome beats and movements. That is, skilled street dancers were found to maintain up-movement coordination, also in high frequencies (e.g., 140 bpm) at which non-dancers' up-movement coordination was unintentionally entrained into down-movement coordination [1]. These results may provide a perceptual reason why beginners of street dance perform unstably and inelegantly, and suggests that the auditory-motor coordination of dancers can be differentiated from that of non-dancers by a dynamical parameter inducing bifurcation. Likewise, skilled drummers could be distinguished from non-drummers by scaling a control parameter that induces phase wanderings in the relative phase dynamics of bimanual drumming [2]. Together, these results emphasize that rhythmic acoustic stimuli not only specify movement frequency but also contribute to the associated coordination dynamics [3-5]. In this symposium possible perceptual supports for enhancing artistic

performance will be discussed as well as implications for and from theoretical modeling. [1] Miura A, Kudo K, Ohtsuki T, Kanehisa H. Hum Mov Sci 2011; 30:1260-71 [2] Fujii S, Kudo K, Ohtsuki T, Oda S. J Neurophysiol 2010; 104:2178-86 [3] Byblow WD, Carson RG, Goodman D. Hum Mov Sci 1994; 13:3-28 [4] Jirsa VK, Fink P, Foo P, Kelso JAS. J Biol Phys 2000; 26:85-112 [5] Kudo K, Park H, Kay BA, Turvey MT. J Exp Psychol Hum Percept Perform 2006; 32:599-609.

Auditory-motor synchronization in sports, the arts, and rehabilitation. Paper 3: Auditory-motor synchronization in gait rehabilitation—optimal coupling for optimal effects

Roerdink, Melvyn, Beek, Peter J.; VU University Amsterdam

Acoustic rhythms are frequently used in gait rehabilitation, with positive instantaneous and prolonged transfer effects on various gait characteristics. They may enhance pathological gait by creating a stable coupling between footfalls and the acoustic rhythm (i.e., auditory-motor coordination). The gait modifying ability of acoustic rhythms largely depends on how well gait is tied to the beat. We illustrate various methods and measures to manipulate and assess the strength of this auditory-motor coupling (e.g., frequency detuning and phase perturbations), all based on the dynamics of the relative phase between footfalls and the acoustic rhythm. Findings show that footfalls are typically anticipating the beat to various degrees [1-3], depending on the frequency detuning relative to the preferred cadence. Gait is coupled best to the beat for frequencies near the preferred cadence [3], as evidenced by superior auditory-motor coordination results (i.e., lower phase variability, faster phase recovery following perturbations). Likewise, superior auditory-motor coordination was observed for pacing two versus one footfall per stride and for healthy versus patient groups [2,3]. Interestingly, frequency detuning and phase perturbations may not only be employed to evaluate auditory-motor coupling but also have promising implications for evaluation and training of gait adaptations. In conclusion, the gait modifying ability of acoustic rhythms (e.g., to improve gait symmetry, to modulate cadence, to elicit step adjustments via rhythm perturbations) depends on the strength of the auditory-motor coupling. The operational repertoire of the coordination dynamics approach may be exploited to identify optimal coupling situations, thereby contributing to a more effective use of acoustic rhythms in rehabilitation. [1] Pelton TA, Johannsen L, Huiya Chen, Wing AM. Neurorehabil Neural Repair 2010; 24:428-34 [2] Roerdink M, Lamoth CJC, van Kordelaar J, et al. Neurorehabil Neural Repair 2009; 23:668-78 [3] Roerdink M, Bank PJM, Peper CE, Beek PJ. Gait Posture 2011; 33:690-4

Sport and Exercise Psychology

Title: The youth sport parenting experience: Role socialization, contextual considerations, and educational recommendations

Organizer: Travis E. Dorsch, Purdue University

The youth sport parenting experience: Role socialization, contextual considerations, and educational recommendations

Dorsch, Travis E., Purdue University

Organized youth sport is a salient developmental context for children (Côté & Fraser-Thomas, 2007). However, children are not the only active participants in the sport setting. Through their involvement in the youth sport context, parents also experience cognitive, behavioral, and emotional outcomes (Dorsch et al., 2009; Snyder & Purdy, 1982; Weiss & Hayashi, 1995). Recently, research has begun to explore the processes by which one becomes a "sport parent," particularly the person- and context-related factors that guide this transition over time. The goal of this symposium is to address the youth sport parenting experience through empirical work that details the processes and outcomes of youth sport parenting. The symposium will begin with a brief overview of extant sport parenting literature. Four youth sport parenting studies will then be presented, representing a breadth of sports and child developmental levels. Through the lenses of ecological theory and socialization theory, the first study addresses the initial processes by which parents become "sport parents." The next study addresses the link between parent experiences in youth sport and interactions with coaches, athletes, and the sport context. The third study overviews the interplay of parent achievement motivation and child emotion in sport. The final study focuses on the factors that influence parents' experiences and on identifying strategies to enhance the parent experience at competitions. The discussant will then address current themes and future directions in sport parenting research.

The youth sport parenting experience: Role socialization, contextual considerations, and educational recommendations—Parent socialization through the early months of organized youth sport involvement

Dorsch, Travis E.; Smith, Alan L.; McDonough, Meghan H.; Purdue University

Research has addressed parent involvement and perceptions in youth sport (e.g., Holt et al., 2009; Snyder & Purdy, 1982; Weiss & Hayashi, 1995), but little is known about the developmental processes by which parents are socialized through sport. The aim of this study was to document family processes and parent outcomes that occur during the initial period of involvement in organized youth sport. We studied four youth sport families from the onset of the first child's participation in organized youth sport through the subsequent 15 months. Using a collective case study paradigm (Stake, 2005), parents, athletes, and coaches were interviewed, parents completed journals, and parent spectators were observed and audio recorded during competitions. These data were collected and analyzed through an iterative process (Strauss & Corbin, 1998). Data were deductively coded according to the framework of parent sport socialization forwarded by Dorsch and colleagues (2009), while unique developmental themes were inductively coded. Based on the assessment of these themes, over time and across families, four propositions are forwarded: (1) sport provides a unique and dynamic context for family development; (2) sport becomes a center of family communication, scheduling, and parenting time; (3) parents' initial goals for children in sport are similar, but are subsequently adjusted based on the child's ability and outcomes; and (4) the first child's initial sport participation provides parents with a novel context for learning and social interaction. These data highlight the intersection of parent sport socialization and family development, and extend recent descriptive work (e.g., Dorsch et al., 2009; Holt et al., 2009) by viewing parents and families in an ecological setting, through a developmental lens.

The youth sport parenting experience: Role socialization, contextual considerations, and educational recommendations–Parental perceptions of Little League coaches and the impact on intentions for future participation

Kaye, Miranda P., Ithaca College; Ullrich-French, Sarah, Washington State University; Vosloo, Justine, Ithaca College

This project examined parent perceptions of youth sport coaches. Specifically, parents' reasons for participation and perceptions of coaches were examined to determine their impact in their child's continued or discontinued involvement. Participants were 48 mothers and 21 fathers of Little League (LL) players (involved with LL $M = 3.43$, $SD = 1.48$ years) who completed an online survey with quantitative measures (purpose of sport and perceptions of the coach, and achievement goal questions) and qualitative measures (prompts about experience with LL and their child's coach). The majority of perceptions were positive, although they tended to decline with child's age and level of participation (all $p < .05$). Parents were less likely to anticipate continued participation if they didn't like the current coach ($t = -2.61$, $p < .05$). Twelve coach behaviors were related to continued involvement and three coach behaviors were related ($p < .05$) to discontinued involvement (a win-at-all costs attitude ($t = -2.75$), overreacting to questionable calls ($t = -2.76$), and playing favorites ($t = -4.43$). From the qualitative data, 169 themes were identified (71% negative). These themes represented bad coaching (37%), good coaching (14%), and the structure/organization of LL (10%). Overall the data revealed three main findings: (1) although parents didn't want their child to be benched, parents seemed to approve of benching less skilled players as evidenced by a relationship between benching less skilled players and positive comments ($r = .37$, $p < .01$); (2) parents who responded with more negative comments were more likely to perceive that coaches did not reward player effort ($r = -.27$, $p < .05$); and (3) although parents did not want their child to be coached with a "win at all costs attitude," parents who believed that coaches focused on winning provided more positive comments ($r = .28$, $p < .05$). These findings indicate that as many parents anticipate continued LL (78%) involvement, the LL environment could be improved for youth, parents, and coaches.

The youth sport parenting experience: Role socialization, contextual considerations, and educational recommendations—Parent achievement motivation and precompetitive anxiety in young swimmers

Kaye, Miranda P., Vosloo, Justine; Ithaca College

This study examines the close relationship between youth athletes and their parents and how this impacts the youth's sport performance. A defining feature of a close relationship is that one person's psychological states and actions have the capacity to influence those of another person (Rusbult & Van Lange, 1996). Studies show that emotional transmission is a common occurrence in close relationships (Larson & Almeida, 1999; Larson & Richards, 1994). Youth sport competition may be a stressor for both young athletes and their parents. Thus, the purpose of this study was to examine the effect of parent achievement motivation on precompetitive anxiety in young swimmers. Participants were 38 ($n_{male} = 18$; $n_{female} = 20$) competitive youth swimmers participating in a Level 3 USA Swimming team in the northeastern region of the US and one of their parents/guardians ($n_{male} = 9$; $n_{female} = 28$). Swimmers ranged from 8 to 18 years of age ($M_{age} = 12.32$; $SD = 2.67$) and reported between 1.5 to 12 years of swim team experience ($M_{years} = 5.66$; $SD = 2.47$). Parents ranged in age from 40 to 58 years ($M_{age} = 47.46$; $SD = 4.96$). Participants completed

a packet of questionnaires assessing achievement motivation (2 × 2 Achievement Goals Questionnaire for Sport; Conroy et al., 2003) and anxiety (Sport Anxiety Scale-2; Smith et al., 2006). Actor–partner interdependence models (APIM; Kashy & Kenny, 2000; Kenny & Ledermann, 2010) were used for the simultaneous estimation of both individual and dyadic factors. Four hypothesized APIMs for each of the 2×2 achievement goals were estimated using Mplus 6.12 (Muthén & Muthén, 2010). Results indicated that parents' adoption of mastery-avoidance goals, performance-approach goals, and performance-avoidance goals significantly predicted youth's somatic anxiety (βMAv = .14, $p < .05$; βPAv = .39, $p < .01$; βPAp = .42, $p < .01$) and worry (βMAv = .36, $p < .01$; βPAv = .39, $p < .01$; βPAp = .46, $p < .01$). The findings of this study suggest that parents' definitions of competence influence their children's emotional states.

The youth sport parenting experience: Role socialization, contextual considerations, and educational recommendations—Improving parents' experiences at junior tennis tournaments

Knight, Camilla J., Holt, Nicholas L.; University of Alberta

The purpose of this study was to examine parents' experiences of watching their children compete at junior tennis tournaments. Specifically, this study sought to address two research questions: (a) What social-contextual factors influence parents' experiences at tournaments? And, (b) What suggestions do parents have to enhance their tournament experiences? Interviews were conducted with 40 parents of junior tennis players competing in tournaments in Western Australia. Data analysis occurred through an iterative process of data reduction, production of data displays, and conclusion drawing and verification (Miles & Huberman, 1994). Overall, parents' experiences at tournaments appeared to be primarily influenced by four factors, which were labeled: (a) Child's performance and behavior, (b) poor sportspersonship, (c) parent-parent interactions, and (d) the tournament context. Participants provided four recommendations to enhance their experiences: (a) Teach children coping skills, (b) reduce poor sportspersonship, (c) provide education and psychological support to parents, and (d) provide social opportunities for parents. Overall, these results indicate that a variety of factors, ranging from their children's performance to tournament organization influence parents' tournament experiences. The identification of these factors, along with participants' suggested changes, has a number of implications for parent education initiatives.

Title: Presenting an applied model for the use of observation interventions in motor skill learning and performance

Organizer: Barbi Law, Nipissing University

Presenting an applied model for the use of observation interventions in motor skill learning and performance

McCullagh, Penny, California State University East Bay; Law, Barbi, Nipissing University; Ste-Marie, Diane M., University of Ottawa; Rymal, Amanda M., San Francisco State University; O, Jenny, California State University East Bay; Hall, Craig, University of Western Ontario

The use of observation-based strategies for behavior change dates back to the early 1900s (Tarde, 1903; Woodworth, 1922). However, much of this work has been segmented, with few attempts to create an integrated model that explains factors influencing the effectiveness of observation on motor skill learning and performance across both motor learning and sport psychology (e.g., McCullagh et al., 1989). Given the pervasiveness of observation-based interventions in research and applied sport settings, there is a need for an applied model that provides a framework to guide research and practice for those who use observation interventions in applied settings. This symposium presents theoretical and original research to illustrate how the Applied Model for the Use of Observation (Ste-Marie et al., submitted) was developed and how it can be applied in various movement contexts. Following a brief introduction, the first presentation will present the model and the methodology used in its development. Two presentations will follow that examine specific components of the model in greater depth, highlighting gaps within the existing research, and presenting preliminary research findings to support how the model can be used by practitioners as well as researchers. One presentation will focus on research-based recommendations for who should be observed, as well as where and why the observation should occur. This will be framed using findings from research on the use of self- modeling for performance enhancement in competition. The next presentation will critically examine how observation-based interventions should be presented, with a focus on factors such as viewing angle, speed, and frequency of observation. Findings from a study examining slow motion versus real-time observation on motor learning and performance within a training context will be presented. Together, these presentations will illustrate how the Applied Model for the Use of Observation can be used to guide future research that addresses critical gaps in our understanding of the effectiveness of observation-based interventions and to assist with the design and implementation of interventions within applied movement settings.

Presenting an applied model for the use of observation interventions in motor skill learning and performance—An applied model for the use of observation

Ste-Marie, Diane M., University of Ottawa; Law, Barbi, Nipissing University; Rymal, Amanda M., San Francisco State University; O, Jenny, California State University East Bay; Hall, Craig, University of Western Ontario; McCullagh, Penny, California State University East Bay

There is a vast literature base concerning the positive influence of observation on our motor behaviors. While much of the research has been couched in a variety of theoretical frameworks, and despite the fact that using observational techniques is widespread in the real world, to date there has not been a conceptual model to guide the use of observation by practitioners. In this presentation, we provide a synopsis of more than 100 research articles that involve observation interventions with the goal of enhancing learning and/or performance of applied tasks in training, competition, and rehabilitation environments. Each article was examined within the 5 *W*'s (where, what, who, when, why) and 1 *H* (how) structure of journalistic research (Beveridge Mackie, 2010), such that the research question(s), design used, and results obtained could lead to a better understanding of the current state of knowledge of observation research. Through this process, it can be stated that, whether video-based or live, skilled models contribute positively to motor skill acquisition in laboratory training situations for novice learners for a large variety of sport tasks. This statement is fairly restricted due to the fact that the research has been so narrow in its scope of investigatory questions concerning the use of observation. Following the synopsis

of literature, an applied model for the use of observation will be advanced. In this applied model, we propose that practitioners should first assess the observer and task characteristics for any observation intervention being created. The practitioner should then gain an understanding of the context and the desired outcomes of the learner and use this advance information to vary the characteristics of: (1) who is observed, (2) what is observed and what instructional features will accompany the intervention, (3) when it is observed, and (4) how the observed information should be delivered. Future research directions will also be forwarded with regard to identified gaps in the literature.

Presenting an applied model for the use of observation interventions in motor skill learning and performance. Who, where, and why: Factors to consider when examining and implementing observation techniques

Rymal, Amanda M., San Francisco State University; Hall, Craig, University of Western Ontario; Law, Barbi, Nipissing University; Ste-Marie, Diane M., University of Ottawa

Recently Ste-Marie and colleagues (submitted) have advanced the Applied Model for the Use of Observation to guide motor learning and sport psychology researchers and practitioners. Following an extensive analysis of the literature, Ste-Marie and colleagues have suggested that significant gaps still exist regarding the 5 *W*'s (where, what, who, when, why) and 1 *H* (how) of observation. The focus of this presentation is to first identify some of these gaps in the literature relating to who is being observed, where observation is being administered, and why observation is being used. As an example, the majority of research has been situated in a laboratory context examining skill learning while very little has explored performance in a sport competition context. Following this review, findings of recent research examining the who, where, and why will be presented. More specifically, the present experiment examined the effects of observing a feedforward self-model (who) during competition (where) on gymnasts' bar performance. The secondary purpose was to examine why participants used the video. The results of the physical performance data was moderated by the observer characteristic of visual imagery ability. That is, gymnasts low in visual imagery ability benefitted from the use of the self-modeling video later in the season, $F(1, 16) = 5.976$, $p = .026$, $R^2 = .27$, $(1 - \beta) = .63$, but not early in the season. The qualitative analysis of interview questions suggested that not only did the gymnasts choose to use the feedforward self-modeling video as a task analysis strategy before, during, and after their competitive event but it also increased their self-motivational beliefs, task analysis strategies, and adaptive inferences. Discussion will focus on practical implications and future directions relating to who, where, and why of observation.

Presenting an applied model for the use of observation interventions in motor skill learning and performance. "Watch this . . . ": Does the "how" of observation-based intervention matter?

O, Jenny, California State University East Bay; Law, Barbi, Nipissing University; McCullagh, Penny, California State University East Bay; Forrest, Chris, Nipissing University; Webb, Shannon, California State University East Bay

Recently, it has been suggested that it may be possible to increase the effectiveness of one's observation use through manipulation of several model presentation characteristics (Ste-Marie et al., submitted). This presentation will discuss several of these characteristics: the angle at which the model is viewed, the frequency of model presentation, and the

speed of video demonstration. Inconsistent methodologies as well as gaps in the relevant observation literature will be highlighted, followed by research-based recommendations for effective intervention design relative to the 'how' of observation. Last, we will overview a recent experiment comparing the effects of slow-motion versus real-time video observation speeds on golf putting performance (9-hole putting course). In this experiment, golfers (preliminary $N = 25$) participated in a 2-week observation intervention where participants were assigned to one of three groups: slow-motion observation + physical practice (SMO), real-time observation + physical practice (RTO), or a physical practice-only group (PP). It was hypothesized that the RTO practice group would outperform the SMO and PP practice groups at post-test, retention, and transfer. Participants were scored based on the number of putts required to hole each putt, as well as the total strokes taken to complete the 9-hole course. Preliminary results generally indicate an increasing putting performance trend by the RTO practice group (i.e., fewer putts required to hole each putt) and interestingly, a decreasing putting performance trend by the SMO group, across experimental phases (i.e., baseline, post-test, and retention). These preliminary findings support the suggestion that one may need to purposefully select a model viewing speed that is appropriate for the functional goals of his or her observation use. Limitations of the current experimental design as well as future directions for observation research focused on the 'how' of observation will be discussed.

Motor Learning and Control

Title: Advances in attentional focus research: The search for mechanisms underlying the external focus advantage

Organizer: Gabriele Wulf, University of Nevada, Las Vegas

Advances in attentional focus research: The search for mechanisms underlying the external focus advantage

Wulf, Gabriele, University of Nevada, Las Vegas

Research on focus of attention (FOA) has been ongoing since initial experiments nominally studied the phenomenon almost 15 years ago, although the roots of the phenomenon go back even further. The most influential reviews of FOA research occurred almost 5 years ago (Wulf, 2007a,b). Since that time, theoretical approaches related to FOA have evolved considerably, and experimental data have revealed physiological changes that underlie the behavioral effects of attention. These recent theoretical and experimental developments integrate the FOA with other robust findings in motor learning and control (e.g., choking under pressure, implicit learning, and the reinvestment of declarative knowledge in the control of movement). The purpose of this symposium is to review these most recent findings, provide clarification, and discuss current and future directions. Specifically, the symposium will discuss the constrained action hypothesis and alternative explanations for FOA effects, the physiological changes the FOA creates in the peripheral nervous system and their effect on movement execution, and will suggest a new, testable framework that ties a small distinction in instructions to a chain of central and peripheral neural and biomechanical activity that results in reliable performance and learning advantages for an external focus of attention.

Advances in attentional focus research: The search for mechanisms underlying the external focus advantage. External focus of attention: Findings, fallacies, and future directions

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

Small differences in the wording of instructions or feedback can influence performance and learning. One line of research in which this has been demonstrated consistently concerns the performer's focus of attention. Instructions directing a performer's concentration or attention externally (i.e., to the movement effect on the environment) have been found to enhance motor performance and learning relative to those inducing an internal focus on body movements. We will review findings showing attentional focus effects for various types of tasks, skill levels, and age groups, and for different demands or dimensions of performance (e.g., accuracy, consistency, efficiency). Methodological issues and apparent inconsistencies in the literature will be discussed. The advantages of an external focus have generally been explained with the constrained action hypothesis (Wulf, McNevin, & Shea, 2001), according to which an internal focus constrains the motor system, whereas an external focus promotes movement automaticity. Alternative explanations that have been put forward will be discussed. We will elaborate on a more recent explanation that has expanded the constrained action notion (Wulf & Lewthwaite, 2010). We suggest that an internal focus of attention may act as a self-invoking trigger in that references to one's body parts or movements may initiate neural activation relevant to the self. This results in micro-choking episodes, which in turn lead to the observed performance and learning decrements with an internal relative to an external focus.

Advances in attentional focus research: The search for mechanisms underlying the external focus advantage. The role of attentional focus in movement execution: Insights and perspectives from force production research

Marchant, David, Edge Hill University

Verbal instruction, feedback, and encouragement are critical tools when guiding others' movements. Research showing that the direction of attention emphasized in verbal instructions influences motor skill acquisition and performance has led researchers to apply this approach to force production tasks. Effective production and maintenance of forceful movements requires a complex interaction between cognitive, psychological, and physiological variables. Of these many variables, attentional focus has been differentially defined and utilized in both research and practice. However, recent evidence indicates that force production tasks are sensitive to verbally manipulated attentional focus in line with the approach advocated by Wulf (see Wulf, 2007, for review); externally focused instructions (onto movement outcomes, or onto the object force is being exerted against) are shown to be more beneficial than internally focused instructions (focusing attention onto the movements being executed). The associated mechanisms indicate that an external focus promotes movement efficiency in line with energy and effort conservation. Research will be reviewed demonstrating these effects in maximal and accurate force production tasks, and in muscular endurance tasks. However, potential limits to the effects are highlighted, such as movement speed, movement complexity and participants' skill level and expectations. Of particular focus is how this developing body of work interacts with the broader understanding of psychological and physiological factors implicated in

the effective production, maintenance and limitation of maximal or sub-maximal forces and the perceptions of such effort. These converging areas of research will be highlighted to propose additional perspectives, conceptual differences, associated mechanisms and methodological issues, and to suggest future research directions.

Advances in attentional focus research: The search for mechanisms underlying the external focus advantage—A neurophysiological framework for the focus of attention

Lohse, Keith, University of Colorado, Boulder

Recently, research on the focus of attention (FOA) has begun to explore the physiological changes in movement that underlie the behavioral effects of attention on motor performance (see Wulf, 2007, for review). From on these recent physiological data, we propose an initial framework to explain FOA effects based on neurophysiological theories of motor learning. Similar to other theories of implicit/explicit motor control, we posit that an internal FOA leads to a motor control strategy that is more novice-like and reminiscent of the control strategy that a performer used earlier in the learning process. At the base of this framework are three findings: (1) an internal FOA leads to freezing of degrees of freedom in multi-joint movements, (2) freezing degrees of freedom in this way prevents the exploitation of redundant dimensions in the movement space, and (3) an internal FOA disrupts intermuscular coordination at the most basic levels by increasing agonist/antagonist cocontraction. This framework posits that an internal focus of attention constitutes a regression to a more novice-like form of motor control; a conscious attempt to increase joint stiffness (through increased cocontraction) in order to decrease variability in the movement pattern, often at the expense of the movements effectiveness. This framework explains current behavioral and physiological findings (which will be reviewed) and makes specific predictions about central and peripheral nervous system changes than underlie the effects of FOA.

Sport and Exercise Psychology

Title: Imagery ability, perspectives, and preference: Insights for developing effective interventions

Organizer: Nichola Callow, Bangor University

Imagery ability, perspectives, and preference: Insights for developing effective interventions

Callow, Nichola, Bangor University; Cumming, Jennifer, University of Birmingham; Guillot, Aymeric, Université de Lyon; Hall, Craig, University of Western Ontario

Imagery enhances the acquisition and execution of motor performance (Callow & Hardy, 2005), with athletes using imagery for a variety of functions (Hall et al., 1998). The effectiveness of imagery is known to be moderated by a number of factors including; imagery ability (Cumming & Ramsey, 2009), visual imagery perspective (Hardy & Callow, 1999), and preference (Calmels et al., 2006). Further, functional equivalence between actual performance and imagery is advocated (Holmes & Collins, 2001; Smith et al., 2007). However, very few studies have manipulated these moderators, especially in the context of youth sport. This symposium will present four original research studies focusing on these moderators,

with an overarching theme of effective intervention. In Study 1 the low imagery ability of youth athletes was increased via a 15-min individual imagery ability intervention. In Study 2 youth athletes received a 5-week imagery ability intervention, with no significant increase in imagery ability or performance. However, increases in external visual imagery were greater than internal visual imagery. These results are contrasted with those of Study 1. In Study 3, when comparing actual swimming turn times with imagery of the turn, physical fatigue was shown to influence internal visual imagery time and physiological response but not external visual imagery time nor imagery ability. The differential effect related to visual imagery perspectives is discussed, along with the influence of central fatigue. In Study 4, while taking imagery ability into account, the interactive effect of external visual imagery perspective and visual imagery preference was explored. Although external visual imagery significantly increased performance, no interaction between perspective and preference was revealed. Together these studies highlight the importance of imagery ability criteria, and considering moderators for both rigorous imagery research and effective applied intervention.

Imagery ability, perspectives, and preference: Insights for developing effective interventions—Changing imagery ability: Practice vs. awareness

Hall, Craig, University of Western Ontario; Munroe-Chandler, Krista, University of Windsor; O, Jenny, California State University; Hall, Nathan, University of Winnipeg

Everyone has the ability to create and use images, but not to the same degree. It has been argued that imagery interventions are more effective with those individuals who are better imagers (Callow, et al., 2001). Moreover, imagery ability can be improved with practice (Rodgers et al., 1991). Before conducting an imagery intervention, typically the imagery ability of the participants is assessed. The aim of the present study was to investigate the effect of a motivational general-mastery imagery intervention on the self-efficacy of seven youth squash players (mean age = 10.71 years) employing a multiple-baseline design. The intervention was conducted over a six-week period. Prior to the intervention, the imagery ability of the players was assessed using the Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997). Using the same criterion employed by Callow et al., four of the players failed to obtain the minimum criterion score on the MIQ-R (i.e., 16 on each of the visual and kinesthetic subscales) required to start the intervention. These players participated in an individual imagery training session lasting approximately 15 min, and a checklist was employed to ensure a consistent imagery training protocol. Several days after this training session, the MIQ-R was then re-administered to each of the four participants. All four participants now demonstrated acceptable levels of both visual and kinesthetic imagery ability in the post-imagery training MIQ-R administration and started the intervention. The focus of this presentation is on whether these improvements in MIQ-R scores, and similar improvements reported in previous studies (e.g., Callow et al.), are a function of practice or an increased awareness of imagery capabilities.

Imagery ability, perspectives, and preference: Insights for developing effective interventions—Does PETTLEP imagery improve imagery ability and learning of visuomotor skills in youth athletes?

Cumming, Jennifer; Cooper, Andrew; Crowley, Hannah; Geeson, Joseph R.; Quinton, Mary; Gray, Robert; University of Birmingham

Imagery is an effective way of learning motor skills, but rarely investigated in children. To fill this void, we examined the impact of a PETTLEP imagery intervention on imagery ability and the performance of a visuomotor task in youth athletes. PETTLEP imagery involves manipulating seven elements (physical, environment, task, timing, learning, emotion and perspective) to increase the similarity between imagery and execution of the same skill (Holmes & Collins, 2001). It is yet unclear what effect manipulating the elements has on imagery ability. In the same way that PETTLEP imagery manifests greater performance improvements than more traditional imagery approaches (e.g., Ramsey, et al., 2010) it may also help individuals to more easily create images. Twenty male Futsal players (mean age = 9.26 years) were matched in age and randomly assigned to PETTLEP imagery or placebo control groups (n = 10 each). Imagery abilities were assessed using the Movement Imagery Questionnaire for Children (MIQ-C; Martini, et al., under development). The visuomotor task involved dribbling a ball with the non-dominant foot then quickly and accurately passing the ball to either a left or right side target. The intervention took place twice per week for five weeks during a training session and lasted approximately 5 min each time. The imagery group mentally rehearsed dribbling and passing from their preferred visual perspective in their normal football kit while standing with the ball at their feet. The placebo control received developmentally appropriate nutrition advice. The children found it generally easier to see than feel when imaging, but reported slightly higher external visual imagery than internal visual imagery. After controlling for Futsal experience, the results showed that the nutrition group outperformed the imagery group on a nutritional knowledge test post-intervention, but no significant improvements were found for either group on imagery ability or performance of the visuomotor task.

Imagery ability, perspectives, and preference: Insights for developing effective interventions—Selective effects of physical fatigue on movement imagery ability

Guillot, Aymeric; Di Rienzo, Franck; Hoyek, Nady; Collet, Christian, Université de Lyon

Imagery training frameworks suggest that movement imagery (MI) should be performed in an environmental context matching that of actual practice or with respect to spatial and temporal features of the actual movement (Callow et al., 2006; Guillot & Collet, 2008; Holmes & Collins, 2001). Despite this, experimental studies examining the effect of physical fatigue (i.e., a common feature of actual practice/movement) on MI are sparse and yielded a divergent pattern of findings (Demougeot & Papaxanthis, 2011; Guillot et al., 2005). Here we investigated whether fatigue occurring during an intense sport training session might affect MI ability. Twelve swimmers (mean age = 15.4 years) conducted a physically fatiguing protocol (training session) where they swam for 45 min from 85% to 100% of their maximal aerobic speed. During both pre- and post-training sessions, participants mentally performed a swimming turn from an Internal Visual Imagery (IVI) and External Visual Imagery (EVI) perspective (20 randomized trials). MI time and autonomic nervous system responses (electrodermal activity) were measured for each trial (Collet, et al., 2011), while actual turn time was recorded during the pre-training session. One-way analyses of variance revealed that physical fatigue did not influence self-report imagery ability ratings as measured by a 10-point Likert scale. Conversely, MI times were significantly shorter during the post-test ($p < .01$) than actual turn time. Examining the selective effects of fatigue on EVI revealed no difference before and after fatigue, while significant shorter MI times ($p < 0.001$) and shorter physiological responses ($p < 0.001$) were observed during IVI. Taken

together, these data support that unlike local muscle fatigue, central fatigue occurring during an intense sport training session is likely to affect MI. Temporal features of MI and the first-person perspective would be primarily altered. Such findings shed light on scheduling relevant MI interventions in sport training.

Imagery ability, perspectives, and preference: Insights for developing effective interventions—The potential interactive effects of visual imagery perspective and preference on a form-based task

Callow, Nichola; Roberts, Ross; Amendola, Julie; Bangor University

Research demonstrates that visual imagery perspective moderates the effect of visual imagery on motor performance; with external visual imagery (EVI) producing significant performance gains in comparison to internal visual imagery (IVI) for form based tasks such as gymnastics (e.g., Hardy & Callow, 1999). Interestingly, athletes often report a preference for using either EVI or IVI (e.g., Calmels et al., 2006) yet it is not known whether imagery preference moderates the effectiveness of a particular imagery perspective. Thus, this study explored the potential interactive effect of visual imagery perspective and preference on the performance of a form-based task. Fifty-one participants completed an adapted version of the Vividness of Movement Imagery Questionniare-2 (VMIQ-2; Callow & Roberts, 2010) including a preference scale. Based on imagery ability imagery and preference scores, 30 participants (mean age = 22.7 years) were allocated to either an EVI preference, IVI preference, or a control group containing an equal number of participants with an EVI or IVI preference. Participants completed a gymnastics routine in 7 blocks of 3 trials. Both imagery groups received an EVI script, and the control group completed a set of maths problems. Performance was captured by a 12-camera VICON Nexus System. Thirty-three joint angles were determined, measured, and the deviations of the 33 angles from those of an expert's performance calculated. Deviations were then averaged across each block. A mixed model (group × block) ANOVA revealed a significant group by block interaction F (6.73, 90.80) = 2.16, $p < .05$. Follow-up tests revealed that the EVI and IVI groups were significantly different from the control group from block 4 onward, with no significant difference between the imagery groups. These results indicate that although EVI significantly improves performance, in the present study, there is no interactive effect between EVI and visual imagery preference for a form-based task.

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Motor Learning and Control*

The Effects of Self-Controlled Video Feedback on the Basketball Set Shot

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The purpose of the current study was to examine the effects of self-controlled video feedback on the learning of the basketball set shot. Female participants were assigned to self-control (SC) (n = 14) and yoked (YK) (n = 14) groups. SC participants were allowed to request video feedback in the form of knowledge of performance (KP) following any trial while YK participants received video KP according to the schedule created by their SC counterpart. Participants in both groups were also allowed to view a poster of written instructional cues at any time. An acquisition phase consisted of 25 set shots (five blocks) from a youth free throw line (3.66 m). Each trial was 30 s in duration. An additional 30 s break was given between blocks. Retention and transfer phases each consisted of ten trials (two blocks) and occurred 24 hours following acquisition. Retention was administered from the youth free throw line and transfer from a traditional free throw line (4.57 m). Participants were scored on both movement form and shooting accuracy during acquisition, retention, and transfer. Results indicated that the SC group had significantly higher form scores than the YK group during Blocks 3 and 5 of acquisition and during the transfer phase. In addition, the SC group looked at the instructional cues more frequently than the YK group. Both groups increased shooting accuracy during acquisition ($p < .05$), but did not differ from one another during any of the experimental phases. A number of results differed from previous research findings. The responses of participants on a post-training questionnaire indicated no preference for requesting or receiving feedback following so-called good trials as reported by Chiviacowsky & Wulf (2002, 2005). In addition, there were no differences in accuracy or form between feedback (i.e., good) and no feedback (i.e., poor) trials. Overall, the results indicated that self-controlled video KP facilitated learning of correct shooting technique.

Differential effects of clutter during gait in Parkinson's freezers and non-freezers

Almeida, Quincy J.,; Tan, Tracy; Wilfrid Laurier University

While freezing of gait (FOG) has been reported to occur frequently in cluttered environments, how clutter specifically influences characteristics of gait in Parkinson's disease (PD) has not been studied. The current study investigated gait through an environment with clutter located directly adjacent to the path (direct clutter) versus clutter located at the perimeter of the room (indirect clutter). This study was driven by the hypothesis that clutter located close to the path might be perceived as more threatening by individuals with PD who experience FOG. 10 PD patients without FOG, 11 PD patients with FOG, and 16

*The abstracts are alphabetically arranged by the first author's surname within each of the three sections—Motor Learning and Control, Developmental Perspectives: Motor Control/Coordination/Rehabilitation, and Sport and Exercise Psychology.

healthy age-matched participants walked down a 7-m path in direct or indirect clutter. All groups had significantly smaller steps in the direct clutter condition (compared to the indirect condition). More importantly, PD-FOG had significantly smaller steps than both groups across both conditions ($F(2,34) = 4.7525$, $p < 0.02$). While groups performed with similar variability of both step time and step length in indirect clutter, the PD-FOG group was the only group to significantly increase both variability measures in direct clutter ($F(2,34) = 4.5378$, $p < 0.02$; $F(2,29) = 7.534$, $p < 0.003$). Additionally, while both Healthy controls and PD non-FOG had similar (low) cadence in the direct condition, while PD-FOG had a higher cadence when compared to indirect $F(2,34) = 4.121$, $p < 0.02$). FOG episodes were only observed during the direct condition, and consistently occurred at the narrowest section of the path. These results indicate that while all older adults were influenced by direct clutter, only PD-FOG adopted a significantly more cautious gait pattern. Findings are discussed from both attentional and sensory-perceptual viewpoints.

The perceived index of difficulty affected accuracy more than movement time in a rapid tapping task

Alphonsa, Sushma; Zhu, Qin Arthur, University of Wyoming

Donkelaar (1999) studied the pointing performance when pointers were subject to the Ebbinghaus illusion. The pointing movement times for the perceptually smaller targets were found to be longer than those for the perceptually larger targets. In a rapid tapping task, the index of difficulty (ID) is determined by both target size (S) and target distance (D) (Fitts, 1954). Would tapping performance be affected by the perceived ID as well? We created four visual images in which the perceived ID was manipulated. Two images represented the illusionary condition, where the perceived ID was manipulated by the combined Muller-Lyer and Ebbinghaus illusions and the actual ID remained unchanged. The other two images represented the control condition, where the perceived ID was manipulated by changing actual ID. Using a computerized tablet system, sixteen right-handed adult subjects were recruited and asked to make a rapid tap on targets from left to right when those visual images were presented on screen, and their accuracy and movement time of tapping were recorded. In a total of forty trials, each visual image was randomly presented for ten trials, and the perceived level of ID for each visual image was solicited from subjects after experiment. The results indicated that tapping was more accurate when the ID was perceived lower in both conditions ($F_{1, 15} = 8.32$, $p < 0.05$); however, the tapping movement time was mainly determined by the actual ID ($F_{1, 15} = 5.76$, $p < 0.05$). Thus, we conclude that the perceived ID affects more accuracy than movement time in a rapid tapping task.

Can contextual interference help you to become a rock star?

Anderson, David I.,; Phan, Dat; San Francisco State University

The contextual interference (CI) effect has been demonstrated in a range of different tasks and settings, but rarely has it been examined relative to musical skill acquisition. Consequently, we examined whether the classic CI effect —inferior practice performance but superior retention/transfer when learners practice under a random versus blocked schedule—would be seen when learning the drums, guitar, and vocals on a Wii version of the popular video game Rockband. Twenty-two participants were pseudo-randomly assigned to a blocked or random practice schedule following a pre-test on the three instruments. Each group played the same song, *The Middle,* by Jimmy Eat World, 15 times during each

of nine 1-hr practice sessions spread over 4 weeks. The Blocked group completed three practice sessions (45 trials) on each instrument before practicing the next one. The Random group practiced the three instruments in a random order during each practice session. Two trials with each instrument were performed on a retention test and a transfer test, to a different song, given one week after practice. The dependent variable was the percentage of correct notes played at the correct time during the song. Surprisingly, the primary result was a failure to find the CI effect. A 2 (Group) × 9 (Practice Session) ANOVA revealed a significant main effect for Practice Session, $F(8, 160) = 6.8$, $p < .05$, but no group differences during practice, $F(1, 20) < 1$, ns. Separate 2 (Group) × 2 (Trial) ANOVAs on retention and transfer performance also revealed no group differences, $F(1, 20) < 1$, ns, for both tests. The most striking finding was how well participants in the Blocked group maintained on the retention test the level of proficiency they had developed during practice. We discuss how characteristics of the task and the practice setting may have created sufficient interference to facilitate retention and transfer when participants practiced under the blocked schedule.

Separate representations for mental and physical practice effects on movement timing

Baute, Kelly J., Indiana University; Raisbeck, Louisa D., Michigan Technological University; Shea, John B., Indiana University

The mechanisms and processes underlying the effects of mental practice on learning timing in motor skills were investigated with the use of a transfer paradigm. When an individual learns a task and then performs a different task, performance of the second task will reflect the degree to which it and the first task share common mechanisms and processes. Subjects performed a task of knocking four barriers down in response to a stimulus light in 1.6 s. A mental practice (MP) group performed the task mentally, a physical practice (PP) group physically performed the task, and a time estimation (TE) group estimated the time of 1.6 s with no knowledge of the task. All groups received 41 acquisition trials with knowledge of results (KR) provided after the first 40 trials. Subjects received 20 retention trials in the absence of KR following a 2-min filled retention interval. Half the subjects in each acquisition group either performed the task in the same condition and half the subjects performed the task in a different condition than used in acquisition. This resulted in 6 retention groups: PP-PP, PP-MP, MP-MP, MP-PP, TE-TE, and TE-PP. There were no differences in absolute constant error (ACE) among the PP, MP, and TE groups during acquisition, $F(2, 57) = 2.68$, $p > .05$. However, for retention the effect of group was significant, $F(5, 54) = 4.96$, $p < .001$. Performance was less accurate for the PP-MP group than for the PP-PP and MP-MP groups. In addition, retention performance was substantially worse for the PP-MP group than for the MP-PP group. The TE-PP group was significantly less accurate than the MP-PP group. This finding supports the contention that the mental practice group was not simply time estimating during acquisition. These findings argue against the hypothesis that the same mechanisms are at work during physical and mental practice (MacKay, 1981), and support the recent account by Raisbeck, Wyatt, & Shea (in press) that mental and physical performance are facilitated by separate but interacting neural structures.

The effect of load uncertainty and foreperiod regularity on anticipatory and compensatory muscle activity in catching

Berg, William P.; Hughes, Michael R.; Miami University

Persons catching an object use knowledge about object weight to tune anticipatory postural adjustments (APA). However, object weight is sometimes unknown. How does the

CNS cope with load uncertainty in catching? Eckerle, Berg, & Ward (2011) reported that when ball weight was unknown, catchers employed APAs, but that APA magnitude was invariant across ball weights. The CNS generated APAs during the ball drop period that were of similar magnitude to those employed for an intermediate weight in the known ball weight condition. The CNS appeared to scale APA magnitude to afford the best chance of catching the ball, regardless of the weight. The purposes of this study were to a) attempt to replicate the Eckerle et al. finding, b) determine the effect of load uncertainty on compensatory activity in catching, and c) determine if APA and compensatory activity under load uncertainty is influenced by foreperiod regularity. We compared APAs in one-handed catching of balls of known and unknown weights in 28 men (22 ± 1.3 years). Biceps/triceps brachii, anterior deltoid, wrist flexor, and bilateral paraspinal activity was measured using EMG as participants caught visually identical balls of 0.5, 1.33, 2.17, and 3 kg under varied (1-10 s) and constant (3 s) foreperiods. EMG integrals were computed for three periods in advance of a catch including from ball drop (BD)-500 ms to BD-100 ms, BD-100 ms to BD, BD to catch(C), and one post-catch period from C to C+500 ms. Our findings of significant ball weight by knowledge condition interactions for all muscles during the drop period were consistent with that of Eckerle et al. Prior to ball drop, conversely, load uncertainty influenced APA activity in wrist flexors only. As for compensatory activity, we found ball weight by knowledge condition interactions for 5 of 6 muscles. In particular, participants exhibited elevated compensatory activity when catching the 0.5 and 1.33 balls under load uncertainty. Neither APA nor compensatory activity was influenced by foreperiod regularity. In sum, the CNS copes with load uncertainly in catching via modulation of APAs in multiple muscles during the ball drop period, but in the wrist flexors only prior to ball drop. Also, load uncertainty causes catchers to exert greater compensatory effort.

Taking a punt on skill testing: Out of the lab and onto the sports field

Berry, Jason; Millar, Lucy; O'Brien, Brendan; University of Ballarat

Skill differences between expert and less-skilled performers have routinely been demonstrated in the laboratory using representative tasks such as video simulation. While this paradigm has provided a high-level experimental control, the research-practice nexus in sport has not greatly benefited from this wealth of empirical information. The aim of this study was to develop and validate a field-based skill test that is ecologically representative of the complex skill demands of the exemplar sport. Australian Football (AF) is a fast-paced contact team sport that requires the players to execute a variety of kick (punt) types to effectively maintain team possession, to achieve tactical and scoring objectives. Assessment for kicking skill in AF has been reported using player interaction with a video simulation. However, assessment in the applied setting is confined to isolated technique analysis or contrived skill drills that do not adequately represent match-like skill demands. This study reports on a newly developed applies Kicking Skill Test (KST). The KST required AF players to execute seven different match- referenced kicks over varying distances and complexity, and was performed in a continuous field-based drill format. Construct validity was assessed with 36 elite football players (12 elite-senior, 12 national-junior, and 12 state-junior) with a comparison of mean test scores across the three skill levels (groups). Results showed a significant difference between the elite-senior group and both the national-junior and the state-junior groups ($p \leq 0.01$). Test-retest reliability was assessed over two consecutive sessions with mean scores demonstrating an ICC value of 0.95 (CI 0.85-0.98) and a CV of 4.9%. The KST demonstrated a high level of construct validity by clearly distinguishing

kicking performance between the elite-senior and elite-junior skill groups. This study provides an example of empirical research with direct applied outcomes such as using the KST for talent identification screening and athlete development monitoring.

Looking beyond the obvious: Intra expertise differences are harder to see!

Berry, Jason; Carlon, Todd; Young, Warren; University of Ballarat

Sport expertise research provides a robust body of knowledge on the characteristics that separate experts from those less skilled. Perceptual skill is recognized as an important factor in agility performance in team sports like Australian Football (AF). However, perceptual-agility research to date has concentrated on inter expertise skill differences (i.e., elite vs. novice). This study investigated the presence of any intra-group differences within a cohort of elite AF athletes on a simulated perceptual-agility task. Specific aims were to 1) identify if AF athletes predetermined as high agility displayed superior perceptual-agility skill compared to low agility AF athletes, and 2) identify if high experience AF athletes displayed superior perceptual-agility skill compared to low experience AF athletes. Fourteen AF athletes performed a video-based Perceptual-Agility Test (PAT) that assessed the athletes' decision time and decision accuracy in response to intercepting an attacking player on the projected simulation. Part 1 of the analysis; the athletes were divided into two groups ($n = 7$ each) by way of median split according to their in-game defensive agility performance scores. *T*-tests were conducted to reveal any differences between the groups in decision time and decision accuracy (Part 1 and Part 2). No significant differences were found in decision time or decision accuracy between the high and low agility AF athletes. Part 2 of the analysis; the 14 athletes (high experience) were compared to a group of low experience athletes ($n = 8$) on their PAT performance. No significant differences were found in decision time or decision accuracy between the high and low experience AF athletes. While there were no observable differences within the cohort of elite AF athletes using the predetermined classifications of agility and experience, this study does, however, confirm the difficulty of revealing intra expertise performance indicators using assessment tools that routinely discriminate a priori levels of skill (i.e., expert vs. novice).

Sensory information processing and self-controlled terminal feedback

Blandin, Yannick, Université de Poitiers; Boutin, Arnaud, IfADo–Dortmund; Badets, Arnaud, Université de Poitiers

Knowledge of results (KR) is considered as one of the most important variables for motor skill learning. However, the question of how non-KR trials are represented in memory and affect later performance has received little attention in models of learning. Among the different KR manipulations, self-controlled KR schedule is thought to enhance skill learning, when compared to frequent KR, by favoring the processing of sensory information. Interestingly, the specificity of practice hypothesis (Tremblay & Proteau, 1998) proposed that early in practice participants are able to determine the source(s) of sensory information that is (are) more likely to ensure optimal accuracy. Participants then value this source(s) of information over all others sources. In this study, the specificity of practice rationale was used to test whether self-controlled KR enhances the sensory information processing. The availability of visual cues during the on-going movement and self-controlled KR were controlled during the acquisition phase. Participants produced flexion-extension movements of the dominant

right arm to produce a specific pattern of displacement over time. This movement was done with or without vision of the limb and with a self-controlled KR or a paired regimen. We tested the ability of participants to transfer the original pattern (extrinsic transformation) or the mirrored pattern (intrinsic transformation) to the unpracticed left arm in the no-vision condition and without KR. Results indicated that the Vision-Self-KR condition suffered a larger detrimental effect of withdrawing visual information than the Vision-Paired-KR condition suggesting that the lack of KR engaged participants in a deeper processing of the visual information, thus reinforcing their dependency on the visual cues. Furthermore, the no-vision condition produced better effector transfer on the extrinsic compared to the intrinsic transformation test. Our results provide an important contribution to the understanding of the interplay between sensory and terminal feedback in the learning process.

Precueing one or both arms of a bimanual asymmetric movement eliminates preparation costs

Blinch, Jarrod, University of British Columbia; Cameron, Brendan D., University of British Columbia; Cressman, Erin K., University of Ottawa; Plecash, Alyson, University of British Columbia; Chua, Romeo, University of British Columbia

In an effort to understand the processing demands of bimanual movements, previous research has compared the time to prepare unimanual, symmetric bimanual, and asymmetric bimanual movements. Most studies (e.g., Marteniuk et al, 1984; Heuer & Klein, 2006) have shown that unimanual movements have faster reaction times (RTs) than symmetric and asymmetric bimanual movements, with asymmetric movements having the slowest RTs. Other studies have found comparable RTs for unimanual, symmetric, and asymmetric movements (e.g., Diedrichsen et al, 2001). However, some of these studies have used simple RT (SRT) designs, while others have used choice RT (CRT). We sought to identify the conditions under which a preparation cost occurs. Our first study investigated RTs of unimanual, symmetric, and asymmetric movements in SRT and CRT conditions. We found that unimanual, symmetric, and asymmetric movements had comparable SRTs (261, 254, 259 ms). CRTs were longer overall than SRTs, and unimanual and symmetric CRTs were not significantly different (276, 284 ms). However, asymmetric CRTs (300 ms) were slower than unimanual and symmetric CRTs. The elimination of the asymmetric RT cost in SRT suggests that the cost is related to the increased processing demands to select and/or program two different unimanual movements – an asymmetric bimanual movement – simultaneously. To investigate the source of the asymmetric RT cost, we conducted a second study in which we precued one arm of the bimanual movements. If the movement for the precued arm can be prepared independently in advance, leaving only one arm of the bimanual movement to be prepared during the RT interval, then we predicted that this would eliminate the CRT cost. Without precues, CRTs for asymmetric movements (295 ms) were generally longer than symmetric movements (278 ms). RTs were faster when one arm was cued, and there was no significant difference between symmetric and asymmetric RTs (264, 262 ms). The elimination of the RT cost with a unimanual precue suggests that each arm of a bimanual movement can be prepared independently.

Off-line concatenation of motor chunks promotes skill transfer

Boutin, Arnaud, Leibniz-Institut für Arbeitsforschung an der TU Dortmund; Blandin, Yannick, University of Poitiers

We investigated the effect of task-relevant information on the chunking process (i.e., unification of responses) and its influence on skill transfer. Using a continuous dynamic motor task requiring participants to make extension/flexion movements with their dominant right arm to sequentially presented stimuli, we forced the formation of motor chunks by providing learners salient information. The same basic 16-element sequence was used for all participants during training. However, in the 8-stim group, only the 8 reversal elements of the sequence were used as stimuli (4*-3-2-1*-2-3*-2*-3-4*-3-2*-3*-2-1*-2-3; * stimuli) but we recorded each of the 16 elements' response time, even though the intermediate elements were not visible. In the 16-stim group, participants responded to each of the 16 presented stimuli. A control 12-stim group was included to circumvent a potential effect of the number of presented stimuli on motor chunk formation (4*-3*-2-1*-2*-3*-2*-3-4*-3-2*-3*-2*-1*-2-3*). Rapid and latent (off-line) representational changes were assessed by 10-min and 24-hr post-training testing sessions, where we tested the ability of participants to transfer the original sequence (extrinsic transformation) or the mirrored sequence (intrinsic transformation) to the unpracticed left arm. Results revealed that providing learners the salient information in the 8-stim group allows them to quickly adapt their movements for task production, i.e., faster development of motor chunks and superior acquisition performance. Practicing the task in the 8-stim condition produced better effector transfer for both an extrinsic (i.e., goal-based skill) and an intrinsic (i.e., movement-based skill) transformation of the sequence at 10-min and 24-hr testing when compared to the 12- and 16-stim conditions. Evidence for a transferable, effector-unspecific component of the sequence structure further emerged during memory consolidation for the 8-stim group and is thought to pertain to the off-line optimization of transitions between successive responses (i.e., concatenation of motor chunks).

Surfing the learning wave

Boutin, Arnaud, Leibniz-Institut für Arbeitsforschung an der TU Dortmund; Blandin, Yannick, University of Poitiers; Badets, Arnaud, University of Poitiers

Motor behaviors can be achieved without awareness, even when performed intentionally. However, the contribution of motor awareness on skill learning has not been investigated yet. Therefore, this study sought to determine the influence of the awareness of our own actions (i.e., top-down processing) on motor control and learning. Generally, when exposed to a regular sequence, individuals unconsciously adapt their actions to exploit the predictable structure of the whole sequence into sub-sequences (i.e., chunking). This unconscious chunking mechanism has been described as a fundamental strategy to facilitate rapid performance improvements, thus providing an indicator of motor adaptation. In the present study, the role of consciousness on motor control and learning was explored using a 12-element motor sequencing task. Participants were required to respond to sequentially presented stimuli by depressing corresponding keys as fast and accurate as possible. After the completion of each practice trial, which consists of only 1 repetition of the motor sequence, participants were instructed to take note of their own performance feelings. Precisely, they responded "yes" when they felt performing the task in the smoothest fashion. Participants assigned to the yoked control group were forced to respond "yes" on the same trials but without any specific judgment of their own performance. Results revealed that an unconscious motor system adaptation (i.e., chunked response pattern) preceded the sudden awareness of the participant's actual behavioral state. Interestingly, we found additional performance improvements linked to the optimization of transitions between

successive responses (i.e., concatenation of motor chunks) shortly after the emergence of motor awareness. Such additional improvements were not observed in the control group. We conclude that unconscious bottom-up mechanisms are responsible for motor adaptation and that metacognitive top-down processing might act positively in enhancing subsequent motor control and learning.

Theta coherence in high-performance athletes: A comparison between amateur, young elite and expert table tennis players

Broelz, Ellen K.; Wolf, Sebastian; Strehl, Ute; Eberhard-Karls-University Tuebingen

Electroencephalographic (EEG) theta coherence (4-7 Hz) was assessed to determine the relationship between cortico-cortical communication and skill level in 17 amateur, 23 young elite and 14 expert table tennis players. Previous research showed that increasing domain-specific expertise occurs along with efficient allocation of neural resources by suppressing task-irrelevant stimuli and mainly processing relevant information. Following this notion, we hypothesize, that during movement planning higher skilled athletes will show more information exchange of the premotor cortex with regions specialized for visuo-spatial processes (right temporal region - electrode location T4) than with areas characterized by verbal-analytical operations (left temporal area – electrode location T3). To enable EEG recordings during a highly reactive sport such as table tennis a motor imagery task was employed. Subjects watched a series of video clips (7 s each) in which a ball was served and were instructed to imagine responding to this serve with a forehand topspin. The 4th second in each video marks the beginning of imagined motor execution. Statistical results showed a significant interaction between skill level and region during the 4th second immediately prior to motor execution ($p < 0.05$). Specifically, amateurs showed lower coherence values at electrode pair Fz-T4 than both young elite and expert players. At electrode pair Fz-T3, however, the coherence estimates were lower in expert and young elite players compared to amateurs. These results suggest, that immediately prior to motor execution expert and young elite table tennis players rely more on visuo-spatial and amateurs more on verbal-analytical processes to guide the planning of their action. This study sheds further light on the neurophysiological differences in motor planning mechanisms between athletes of different expertise, by showing the dissimilarity in the degree of intra-cortical communication between specific brain regions and demonstrating corresponding coherence patterns of players close in skill level.

Age-related differences in force control under visual and auditory feedback

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Old and young adults differ in fine manual force control, but it is unknown whether these differences manifest in the oral motor system, or to what extent force control in aging interacts with sensory feedback. The current investigation examined fine force control in oral and manual effectors as a function of visual and auditory feedback in young and old subjects. We hypothesized 1) that variability of force output would increase more in the finger than in the lip with aging; and, 2) that variability would increase with age for auditory and visual feedback if aging entails change in basic sensorimotor capacity rather than specifically in the visuomotor system. To test these hypotheses, 13 young participants (19-23 years) and 13 older participants (60-77 years) produced continuous force via index

finger flexion and lower lip elevation at two levels (10 and 20% of maximal voluntary force) while attempting to match a visual or auditory target. The standard deviation (*SD*) and coefficient of variation (CV) of force output described the magnitude of force variability, while approximate entropy (ApEn) of force output quantified its structure. Older subjects had greater variability of force output (*SD* and CV) than younger subjects for both sensory modalities ($p < 0.05$). A group by effector interaction for CV indicated that the magnitude of lip variability increased to a greater extent in older subjects ($p < 0.05$). Magnitude of variability (*SD* and CV) was higher under auditory than visual feedback for both age groups ($p < 0.05$). Under visual feedback, young adults had less force structure than older adults under visual conditions, whereas no group differences were seen under auditory ($p < 0.05$). In contrast to our prediction, oral force variability increased with aging more than manual force variability. Age-related differences in force variability are present for both feedback modalities, suggesting age effects on force control are not strictly related to visuomotor integration.

The relationship between motor severity and coordination in a novel upper limb coordination task in individuals with Parkinson's disease

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Individuals with basal ganglia dysfunction such as Parkinson's disease (PD) have impairments when coordinating the upper limbs. Coordination deficits in individuals with PD are dependent on several factors including frequency and phase of movements, availability of sensory feedback, and potentially the physical constraints of the task itself. However, it is unclear how motor symptom severity contributes to coordination performance in individuals with PD. The current study examined a novel, unconstrained (free movement) coordination task requiring continuous wrist flexion-extension. Fifteen individuals with PD performed the task after overnight withdrawal from all dopaminergic medications, as well as fifteen healthy age-matched controls. Phase (in-phase & anti-phase), frequency (0.75-2 Hz) and visual feedback (no vision, normal vision, augmented vision) were evaluated in two consecutive sessions for each participant. Coordination performance was measured by the accuracy (mean) and stability (standard deviation) of relative phase. While statistical analysis did not reveal that PD participants had significantly more coordination deficits compared to healthy older adults (i.e., accuracy and stability of relative phase), a significant correlation between the severity of motor symptoms (as revealed by UPDRS) and coordination error (less accuracy) across all conditions ($r = 0.48$, $p = 0.047$). In addition, decreased stability (as measured by variability in coordination) across all conditions was significantly and highly correlated to the degree of severity of motor symptoms($r = 0.58$, $p = 0.011$). These results suggest that in a less constrained task, individuals with PD are able to dynamically organize coordination as well as healthy participants. However, motor severity in individuals with PD appears to be associated with greater coordination deficits that can be detected with error and variability measures when coordinating the upper limbs. Furthermore, the results support that upper limb coordination is dependent on a distributed neural system that includes the basal ganglia.

Consistency in demonstrations is more important than model skill level in facilitating observational learning of a difficult motor skill

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An experiment was carried out to study how a model's skill level influenced strategy selection and initial performance accuracy in a group of observers. The task was bimanual circle (10

cm diameter) tracing and models practiced a 90 deg relative phase pattern for three days. Six videos with three levels of model performance were constructed from the data of two models. A set of instruction-model videos showed a novice practicing the 90 deg pattern with the same strategy on every trial, left-arm traced counterclockwise (CCW) and right-arm traced clockwise (CW) with a right-arm lead. A set of expert-model videos showed the 10 best trials (9 times each) from the instruction-model presented in random order. A set of discovery-model videos portrayed a novice using several strategies (hands tracing in a variety of CW and CCW combinations and hand leads) when practicing the 90 deg relative phase pattern. Three sets of eight observers each watched one set of model videos over two training sessions. Significant error reduction and performance improvement were portrayed in the instruction and discovery model videos, but not in the expert model videos. In a retention test administered 24 hr after observation, observers of the expert-model and instruction-model performed the 90 deg relative phase pattern with greater accuracy and stability than the observers of the discovery-model. Further training of the observer groups with performance feedback led to a reduction in relative phase error in the observers of the discovery and instruction-models, but not in the observers of the expert-model. The reduction in error was larger for the discovery-model observers. The observers of the instruction and expert-models selected the strategy demonstrated (CW:CCW), this was not the case for the observers of the discovery-model. In conclusion, the data reveal that repetition of the same strategy is a more significant factor influencing observational learning processes than is the initial skill level of the model or the final skill level of the model at the end of observation.

Representing front, back, left and right in auditory space: Action-Based response conditions affect the categorization of egocentric space

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Spatial region concepts such as “front”(F), “back”(B), “left”(L) and “right”(R) reflect our typical interaction with space, and the corresponding surrounding regions have different statuses in memory. For the visual domain, this can be explained by the spatial framework analysis proposed by Franklin and Tversky (1990, JEP:G, 119, 63-76). We examined the representation of spatial directions in an egocentric reference frame, its grounding in the acoustic domain and its dependency on response actions. We investigated whether the categorization of spatial directions would vary accordingly to the response conditions, and accessed the sizes of the regions associated with the concepts F, B, L and R in auditory space (AS). While standing in the middle of a circle with 16 sound sources (SS), participants were presented acoustic stimuli coming from the SS in randomized order, and verbally described the directions of the SS by using the concepts F, B, L and R, and their combinations (FR, FL, BR, BL). Response actions were varied in three blocked conditions: (a) facing front; (b) turning the head and upper body towards the stimulus, and (c) additionally pointing with the hand and outstretched arm towards the stimulus. In addition to a protocol of the verbal utterances, motion capture and video recording were used to generate a detailed corpus for subsequent analysis of the users’ behavior. Chi-square tests resulted in an effect of the response condition for directions within the left and right sides (asymp. sig. < 0.05). In all conditions, F occupied the smallest area, whereas L and R took up the largest area and did not differ from each other. We conclude that movement-based response actions

influence not only the perception of AS, but also its representation, especially within the sides' regions. Moreover, the representation of AS favored the front and the back regions in terms of resolution, confirming the spatial framework analysis for the acoustic domain. In terms of size, however, these regions were not favored, as it normally happens while representing the visual space.

The effects of bandwidth feedback in adaptation to unpredictable perturbations in an isometric task force

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The influence of factors that interfere in motor skills such as feedback and the way it is provided in motor adaptation has been little investigated. The goal of this study was to investigate the effect of bandwidth feedback in adaptation to unpredictable perturbations in a isometric task force. Twenty two undergraduate students inexperienced in task participated in the study (25.14 ± 3.59 years), divided into two groups: Group bandwidth (BG) who received knowledge of results (KR) only when the error has exceeded 5% in relation to the requested percentage of maximum force and the control group (CG), which received KR when there was any difference between the percentage requested and performed. The study consisted of two phases: pre-exposure and exposure, whose trials lasted three seconds. In pre-exposure, volunteers practiced 81 trials with KR in accordance to the specified group had with the goal of reaching and keep 40% of its maximum force during three seconds. During exposure phase conducted immediately after pre-exposure, 18 unpredictable perturbations were inserted interspersed with trials whose goal was to achieve the same percentage of maximum force of the previous phase. These perturbations were characterized by having a new goal to be achieved, with resulted in two different magnitudes of perturbations: nine trials with increment to 60% of the maximum force (PI) and nine trials in which a decrease to 20% of the maximum force (PII), which resulted in126 trials. Comparing the first peak error in PI and the minor force error in PII, PI had smaller error than PII but in both perturbations error diminished from the first to the third block. The analysis of the first peak error in PI the groups has similar performance; however, the error diminished from first to third block. Moreover, BG reached the first peak force after PI was inserted faster than CG. There was no difference in PII. Although bandwidth feedback did not resulted in smaller error, BG adapted faster in PI.

Postural activity and motion sickness among standing passengers and drivers in a car racing video game

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A car racing video game was used to examine the postural activity and motion sickness of standing passengers and drivers. Forty healthy adults (20 men, and 20 women, age range = 19.42-23.83 years; mean height = 169.55 cm, *SD* = 8.96 cm; mean weight = 60.21 kg, *SD* = 10.60 kg) were randomly assigned to form 20 driver-passenger dyads. Each participant was required to stand with heels 30 cm apart and 1.05 m away from a 55 inches LED monitor and play or watch an X-Box 360 (Microsoft. Corp) game, named Forza Motosport for up to 40 min. A magnetic motion tracking system (Flock of Birds, Ascension Technologies, Inc., Burlington, VT) were used to trace the displacement of their head and torso movement

at 40 Hz. A yes/no question and the simulator sickness questionnaire (SSQ) were used to measure the incidence rate and symptom severity of motion sickness, respectively. Eleven drivers (55 %) and 15 passengers (75 %) reported motion sick and the rates did not differ significantly. Mann-Whitney U test indicated that the sick drivers and the sick passengers had higher post-exposure SSQ scores as compared to the well driver, and the well passengers, respectively. Wilcoxon signed ranks test indicated that all drivers and the sick passengers had higher SSQ scores at post-exposure as compared to pre-exposure. Two (Role: driver, passenger) × 2 (Condition: sick, well) × 3 (Time: W1, W2, W3) mixed design 3 way ANOVA with the last factor as repeated measure were performed on the positional variability of the movement data. In both the AP (anterior-posterior) and ML (mediolateral) directions of the Head and Torso movement, the Role effects and the Time effects were significant, $p < .05$. In conclusion, those who reported motion sick suffered from severer symptom, and for all drivers and the sick passengers, symptom severity increased as they exposed to a car racing video game. Postural variability increased as time. Drivers showed larger variability than passengers while standing and playing a car racing video game.

Motion control analysis using Muller-Lyer illusion in handball goalkeeper postures

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The purpose of this study was to investigate how the illusion in handball goalkeeper postures, at the time of handball penalty throw, could affect an attacker's judgment on the location to which the attacker directs the ball and its landing location, using Muller-Lyer illusion figures, based on a theory where there are two streams in the primary visual cortex in the cerebral cortex. The subjects were 10 college handball players and 15 general college students. They conducted a perception judgment task, a location judgment task and a ball throwing task for watching a video on goalkeeping to which Muller-Lyer illusion is applied and making a verbal expression. Then, data on their tasks were analyzed by coordination according to a mouse movement tracking system. Accordingly, the results were obtained as follows. First, both experts and non-experts were influenced by Muller-Lyer illusion, and they perceived the goalkeeper more largely in wing-out, control and wing-in posture in order. Second, non-experts were more influenced by Muller-Lyer illusion, and pointed to about 5% more distant spots, compared with experts. Third, for the actual ball throwing task, they threw the ball in wing-out posture, 85%, control posture, 80%, and wing-in posture, 75%, and non-experts threw the ball farther away, compared with the experts. In view of these results, this study has an important meaning in application of visual illusions to sports situations.

Walking with concurrent cognitive tasks in people with traumatic brain injury

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Concurrent performance of motor and cognitive tasks can be challenging for most people and even more so for those with brain injury. Previous studies investigated concurrent task performance of walking and talking in healthy adults, elderly and stroke population. However, few examined the influence of concurrent tasks on motor performance in people with traumatic brain injury (TBI). Therefore, the purpose of this study was to investigate the influence of concurrent cognitive tasks on gait performance in people with TBI. Methods: A total of 9 people with TBI (age: 41.9 ± 10.6) and 9 healthy controls (42.8 ± 11.1) participated in this study. All participants completed a 20-meter walking course while performing

various types of concurrent cognitive tasks. Each participant walked at their maximum speed under 4 test conditions: a) simple walking (W), b) walking with word generation (WWG), c) walking with answering questions (WQA), d) walking with performing visual tasks (WVT). All walking trials were captured by 3D motion analysis system (Vicon Nexus) for gait analysis. Results: The 3D motion analysis system illustrated that the TBI group had significant reductions in walking speed, stride length, and hip ROM during the WWG performance as compared to W (all $p < .05$). The lower limb kinematic data showed only decreases in hip joint excursion on the affected limb ($p < .031$). Significant group interaction was observed in the spatiotemporal variables, with the TBI group showing greater changes ($p < .05$). Conclusions: Our results indicate that people with TBI have more difficulty in performing multiple tasks involving cognitive functions while walking as compared to those without TBI. The findings suggest that walking with various cognitive tasks can be effective for improving functional gait for people with TBI.

Effects of error tolerance range and bandwidth orientation on a timing task

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When to provide feedback is always an interesting question for practitioners. Bandwidth feedback offers an effective way to determine the timing of feedback contingent upon the size of error by a learner. However, the mechanisms of bandwidth feedback still remain elusive. The purpose of this study was to examine the effect of error tolerance range (bandwidth) and feedback orientation on the accuracy and variability of a timing task. Previous research has shown that a bandwidth of 10% yields better results than 3% (Chen, 2003; Sherwood, 1988). The bandwidth orientation determines whether to provide feedback outside or inside the tolerance range. Fifty-four right-handed undergraduate students were randomly assigned to one of the four groups: 10% traditional bandwidth, 20% traditional bandwidth, 10% reversed bandwidth, and 20% reversed bandwidth. The task requires participants to sequentially depress one four-key sequence (2-4-6-8) on the digit-pad within the designated time of 900 ms using their dominant index finger. Whether or not they received feedback was based on the size of their error in their assigned group. Participants completed 60 trials of practice. Following a 5-min break, a 20-trial retention test was completed. Twenty-four hours later, a delayed retention test of 20 trials was completed. Separate $2 \times 2 \times 3$ (Orientation $\times$ Bandwidth Size $\times$ Trial Block) mix-design ANOVAs on absolute error (AE) and variable error (VE) scores showed that the 10% traditional BW KR produced more accuracy ($F(1, 50) = 36.549$, $p < 0.0001$) and consistency ($F(1, 50) = 5.181$, $p < 0.027$) than the other feedback conditions. Univariate ANOVAs were performed on AE and VE retention data. The results showed more accuracy for the 10% traditional BW KR in both immediate retention ($F(1, 49) = 13.48$, $p < 0.001$) and delayed retention tests ($F(1, 49) = 4.231$, $p < 0.045$). This finding suggests that 10% error tolerance range is effective for learning a novel timing task. The author will discuss the pedagogical implications of varying bandwidth orientations for real world coaching and teaching tasks.

Mental practice benefits for memory retrieval

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Research concerning the effects of mental practice on the learning of motor skills has shown it may be superior to no practice but less effective than physical practice, and it may benefi-

cial when used with physical practice (Feltz & Landers, 1983; Driskell, Copper & Moran, 1994). Recent research (Wohldmann, Healy & Bourne, 2007, 2008) has reported a mental practice superiority effect. The present study addressed the incongruence of this finding with earlier studies. A within-subject design was used with five practice conditions which differed with respect to the proportion of mental (MP) and physical (PP) practice received over 16 practice trials on each of 5 tasks (80 total practice trials): MP-0%(16 PP trials), MP-25%(12 PP and 4 MP trials), MP-50%(8 PP and 8 MP trials), MP-75%(4 PP and 12 MP trials), MP-100%(16 MP trials). Each condition was paired with one of 5 sequential key pressing tasks performed on a computer keypad. Retention was measured 20-min. after the practice trials. Diagrams depicting the tasks were not presented for Retention Test 1 (RT1) but were the practice trails. Diagrams depicting the tasks were not 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 using a fully repeated MANOVA for block (acquisition, RT1, RT2) and condition. IT was significantly higher for RT1 than for acquisition and RT2, $p < .001$. IT was faster for RT2 than for acquisition and RT1, $p < .001$. Similarly, RT1 resulted in slower ET than acquisition and RT2, $p < .001$. ET for RT1 was faster for the MP-50% condition than for the other conditions ($p < .03$). This suggests a practice is optimal for performance when memory retrieval is required. However, mental and physical practice are equivalent for response execution when memory retrieval is not necessary (Raisbeck, Wyatt, & Shea, in press).

The influence of generic versus non-generic feedback on motor performance in children

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Relative to non-generic feedback that refers to a specific event and implies that performance is malleable, generic feedback, implying that task performance reflects an inherent ability, can have detrimental effects on children's intrinsic motivation—particularly after mistakes or poor performance (Cimpian, Arce, Markman, & Dweck, 2007). The present study examined generic versus non-generic feedback influences on motor performance in 10-year old children. During the first phase of the experiment, 2 groups of participants—generic feedback (GF) and non-generic feedback (NGF) groups—performed 12 trials of kicking a soccer ball at a target. After every third trial, different feedback statements were provide, implying either an inherent ability in the GF group (e.g., "You are a great player") or a malleable skill in the NGF group (e.g., "These kicks were very good"). Both groups then performed 6 more trials with (identical) negative feedback after every third trial (e.g., "These kicks were not very precise"). An immediate retention test, consisting of 6 trials without feedback, was performed 10 min later. While there were no differences in shot accuracy between groups in the first phase, the NGF group outperformed the GF group in the second phase (i.e., after receiving negative feedback) and on the immediate retention test. NGF group participants maintained their accuracy relative to the end of the practice phase, whereas that of the GF group declined. Thus, generic feedback can degrade not only intrinsic motivation (Cimpian et al., 2007) but also motor performance or learning, compared with non-generic feedback. The detrimental effects of generic feedback appear to play out particularly when the mistakes occur or performance is less-than-perfect. The type of feedback (generic or non-generic) provided to children may have important consequences for motor performance and learning, and perhaps their future engagement in physical activity.

Self-controlled feedback: The importance of confirming good performance

Chiviacowsky, Suzete, Federal University of Pelotas, Brazil; Wulf, Gabriele, University of Nevada

Recent studies examining the role of self-controlled feedback in motor learning have shown that learners tend to ask for feedback after what they believe was a "good" rather than "poor" trial. Indeed, trials on which participants request feedback are typically more accurate than those without feedback. The present study examined whether manipulating participants' perception of "good" performance would have differential effects on learning. All participants practiced a coincident-anticipation timing task with a self-controlled feedback schedule during practice. Specifically, they were able to ask for feedback after 3 trials in each of 6 10-trial practice blocks. While one group (Self-30) was told that an error of 30 ms or less would be considered good performance, another group (Self-4) was informed that an error of 4 ms or less would be considered a good trial. A third, regular self-control group (Self) did not receive any information about what constituted good performance. The results replicated previous findings in that participants of all groups asked for feedback after relatively good trials during practice, with no performance differences between groups. On feedback trials, the Self-30 group had an error of 30 ms or less, suggesting that the trial was "good," on 53% of feedback trials, whereas the Self-4 group had an error of 4 ms or less on 6% on those trials. Both the Self-30 and Self groups showed greater self-efficacy relative to the Self-4 group at the end of practice, as well as learning advantages on retention and transfer tests (non-dominant hand) performed on the following day. The results demonstrate that the typical learning benefits of self-controlled feedback can be thwarted by depriving learners of the opportunity of experiencing "good" performance. More generally, they add to the accumulating evidence of motivational influences on motor learning.

To avoid or not to avoid (well-learned tasks)—That is the question: A test of uncertainty-based adaptive scheduling for learning

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The issue of how to schedule physical practice of motor skills has received considerable attention. Based on machine learning algorithms it has been suggested that an optimal learner is one who seeks to reduce uncertainty of any particular practice situation (Huang et al., 2008). This would be achieved by avoiding well-learned task components, to devote more practice to unpracticed or errorful movements. Huang et al. (2008) argued that human learners who have control over their schedule are suboptimal in their learning strategy because they do not avoid practicing low error task components. Indeed, self-determined learners showed poorer performance than passive learners who had an imposed schedule. Importantly, however, they did not test for retention. In human motor learning research, giving learners control over practice has resulted in better retention than experimenter imposed schedules (Wu & Magill, 2004, 2005). Learners also like to receive feedback on low, not high error trials (Chiviacowsky & Wulf, 2002). It may, therefore, be important for human learners to practice 'well-learned' task components to receive self-validation, positively impacting retention. Using a visuomotor adaptation task involving 4 targets of varying difficulty we sought to examine whether an uncertainty-based strategy is optimal for learning. Targets were excluded from practice based on performance (< 5 degrees of error over last 5 trials). Preliminary data from 14 participants across 4 factorial groups (Uncertainty-based exclusion or No-exclusion × Self-scheduled or Randomly-scheduled)

showed no support for an uncertainty-based selection strategy. No-exclusion groups were more accurate in retention than exclusion groups. The self-scheduled, no-exclusion group was the most accurate. These data suggest that there are learning benefits to be gained by continued practice on task components with low error. In addition to increasing the sample size and evaluating the practice schedules we also plan to test two "yoked" groups that follow the same schedule as the self-scheduled participants.

Spatial biases for pointing movements generated by sensory and motoric inhibition of return

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Inhibition of return (IOR) refers to a slowing of reaction times for the detection or localization of a target object presented in the same location as a previously attended cue, provided the cue-target stimulus onset asynchrony is at least 300 ms. Currently, at least two forms of IOR are thought to exist: one that affects early (sensory) processes, and the other that affects late (motoric) processes. When sensory processes are inhibited, the spatial distribution of IOR is greatest at the cued location (i.e., a 0° cue-target offset) and decreases monotonically to 180° opposite. In contrast, when motoric processes are inhibited, we previously demonstrated a spatial distribution of IOR for saccadic eye movements where IOR was greatest for 0° and 180° offsets, and smallest for 90° offsets. In order to determine if the same pattern of motoric IOR would be observed in another effector system, we examined the spatial distribution of both sensory and motoric IOR for pointing movements. In two separate experiments, participants made consecutive pointing movements in response to either (1) peripheral onsets, when sensory inhibition is likely or (2) arrows presented at the point of fixation, when motoric inhibition is likely. Participants were required to keep their eyes at center throughout each trial. Four possible target locations were presented in each trial (marked by placeholders). When peripheral onsets were used to signal movements, we observed a typical pattern of sensory IOR, where RTs declined monotonically from a 0° to a 180° offset. In contrast, when central arrows were used to signal movements, RTs were faster only when offset by 90° degrees from the initial movement. These results demonstrate that the spatial topography of motoric IOR is similar for both eye and arm movements, and that motoric IOR has a different spatial distribution than IOR involving sensory processes.

Perturbation direction and use of vision as postural control components by old and young adults

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The growing falls during aging is related to alterations at sensorial, neural and motor functions. Beyond these changes, old adults show difficulties at dealing with perturbations at the balance. In this sense the direction of perturbation that interferes more on postural control is an important question to investigate because there are activities of daily living that challenge postural system in a more accentuate mode that can cause a fall, even if it is a typical movement of daily living. This study has the objective to investigate if the perturbation direction maximizes the instability for old adults and if this behavior is different for young adults. We analyzed 15 old adults (mean age = 68 years) and 15 young adults (mean age = 20 years) who stayed barefoot in a semi tandem position on a force plate looking at a fixed point (1,20 away) for 40 s. The variables analyzed were the COP

dispersion at medial lateral and anterior posterior directions with and without the use of vision. The results showed significant differences between the groups $F(1,28) = 7{,}147$, $p = 0{,}012$, which old adults showed greater values of instability in all variables analyzed than young adults. The comparison of perturbation direction showed significant difference $F(1,28) = 241{,}070$, $p < 0{,}001$, namely medial lateral conditions were more unstable for both groups. For conditions without vision, both groups showed more instability than in conditions with vision $F(1,28) = 51{,}343$, $p < 0{,}001$. The significant interaction between direction and vision, $F(1,28) = 18{,}205$, $p < 0{,}001$, showed that at medial lateral conditions without vision both groups were more instable than at the other conditions. These results showed that the perturbations proposed at the study (semi tandem position and occlusion of vision) were important components to take into account in research related to postural control even for old adults as to young ones. The conclusion of this study is that medial lateral perturbations can be more stressful and induce to greater instability especially in the absence of vision for the elderly.

Influence of postural complexity and whole body vibration on soleus H-reflex activity

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Assessments of the neuromuscular systems responsiveness can provide insight into the ability to attend to and respond to both internal and external challenges to balance, and have been evaluated using the Hoffman reflex (H-reflex). Previous studies have reported a modulation of the H-reflex when assuming an upright standing position compared to a seated/reclined position. Increasing the complexity of the postural task, through alterations of the availability of sensory information, may further highlight this modulatory effect by increasing the postural challenge and was one aim of this study. A second aim was to determine the impact of an acute exposure to whole body vibration (WBV) on the H-reflex. Vibration studies have hypothesized a change in muscle spindle activity and consequently the responsiveness of the neuromuscular system following WBV exposure. To assess these aims, the H-reflex of eight healthy young-adults was assessed across four randomly assigned postural positions (semi-reclined, standing, standing in sway-referenced surround, and with sway-referenced support) both prior to and immediately following 2-min bouts of WBV (30 Hz, 2 mm amplitude) that preceded each postural position. Soleus H-reflex activity was assessed 10 times in each postural position with 10 s between each reflex. To quantify changes in the H-reflex measures of peak-to-peak amplitude (PtoP), mean activation level and H-reflex duration were assessed. Findings revealed a significant decrease in the duration of the H-reflex between the seated condition and when visual information was inaccurate. Significant main effects were found for both postural position and WBV exposure for the measure of PtoP, however, a significant interaction was also found indicating that not all postural positions responded the same way to the vibration. The baseline seated condition showed a larger reduction in PtoP than the three standing conditions. Implication to the changes in neuromuscular responsiveness as a result of challenges to postural stability and WBV will be discussed.

Standing long jump performance with an external focus of attention is improved as a result of a more efficient projection angle

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Attentional focus has been examined in a variety of motor skills (Wulf & Prinz, 2001; Peh et al., 2011). Thus far, research has shown that instructing individuals to focus their attention externally elicits better outcome and performance measures than focusing internally. Recently, investigators have demonstrated a similar effect with standing long jump performance, a ballistic skill. In two separate studies, researchers found that participants improved their standing long jump performance when they directed their attention externally instead of to their leg action (Porter et al., 2010) but found no differences when examining peak force (Wu et al., in press). The purpose of this study was to examine kinetic and kinematic properties associated with the standing long jump that may explain disparities between an internal and external focus of attention. It was hypothesized that the external focus condition would exhibit smaller impulse values and a more optimal projection angle (45°) than the internal condition. Nineteen participants volunteered for the study. All participants performed 5 total jumps—one baseline jump, in which no focus was cued, followed by 4 remaining jumps in which either internal or external focus cues were introduced in a counterbalanced manner. Analysis of variance revealed that the external condition jumped significantly further than the internal condition. Analyses of kinetic measures, peak force and impulse, revealed no significant differences between the internal and external conditions. However, there was a significant difference between the two conditions with respect to projection angle. Specifically, participants in the external focus condition exhibited an average projection angle of 45.7°, while the internal condition produced an average projection angle of 49.5°. Therefore, the observed difference in jump distance between the two conditions can be explained by the external condition producing a more optimal projection angle. The results of this study partially support the constrained action hypothesis.

Positive social-comparative feedback enhances motor learning

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In contrast with blocked or random practice schedules, studies suggest that learner-adapted practice is effective for both performance and learning (Choi, Qi, Gordon, & Schweighofer, 2008; Marchal-Crespo & Reinkensmeyer, 2008). Our previous study asked why this was so (Eliasz, Wishart, & Lee, 2010). The task was to perform several keypress sequences quickly and accurately. Learners practiced the sequences in either a "WinSwitch" or a "WinRepeat" task-switching algorithm, or in one of two control groups yoked to these algorithms. Learning was facilitated by the algorithm (WinRepeat) that offered some blocked practice towards the beginning of practice and mostly random practice towards the end, suggesting that the timing of contextual interference (CI) facilitated learning. As well, the WinSwitch algorithm resulted in retention performance that was worse than both control groups—suggesting that perhaps a second factor, unrelated to CI, might be responsible for degraded learning. To further examine this latter hypothesis, all groups in our present study practiced 160 trials of the same sequences in a WinSwitch schedule and we manipulated the nature of social-comparative feedback that was administered during acquisition—regardless of actual performance. Learners receiving positive or negative social-comparative feedback were shown progressive summaries indicating that they were performing better or worse than their peers, respectively. This fabricated feedback was provided prior to practice (following a familiarization task) and after every 38 trials during practice. Analysis of the acquisition and retention data revealed that providing positive social-comparative feedback overcame the negative effects of the WinSwitch schedule and resulted in greater performance, learning, and self-efficacy beliefs compared to the groups given negative or neutral feedback. Our findings suggest that a more complex relationship

exists amongst the effects of practice schedules and psychological factors (such as self-efficacy) than previously thought. This study was funded by NSERC.

Blocked versus random practice effects on anticipation timing

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Most frequently when blocked and random practice schedules are compared, blocked practice results in better performance during acquisition and random practice results in better performance during retention or transfer. The purpose of this study was to compare the effects of blocked and random practice using an anticipation timing task. The 177 participants (94 females, 83 males) were randomly assigned to three groups. Each group performed 10 practice trials and 5 transfer trials using a Bassin anticipation timer apparatus. One group performed the ten practice trials at a 5 mile-per-hour (mph) speed, another group practiced at 15 mph, and the third group practiced at speeds of 5 and 15 mph on alternate trials. Anticipation times of all groups were then measured during 5 transfer trials at a 10 mph speed. Absolute Error scores were calculated for all measures and significance set to $p < .05$. No differences were found between the 5 and 15 mph blocked-practice groups average anticipation times for the practice session (Means for 5 mph and 15 mph groups = 41.6 and 44.6 ms, respectively). The random-practice group had a significantly greater average anticipation time (mean = 56.9 ms) than both blocked- practice groups for the practice session. For the transfer trials no significant differences occurred between the two blocked-practice groups' averages (Means for 5 mph and 15 mph groups = 59.9 and 62.3 ms, respectively) and both were significantly greater than the random-practice group average (mean = 34.6 ms) for the transfer trials. These results suggested random practice may establish a better memory parameter for anticipation times.

The relationship between motivation and performance in self-control and yoked groups

Fairbrother, Jeffrey T.; Laughlin, David D.; Alami, Arya; University of Tennessee, Knoxville; Post, Phillip G.; New Mexico State University

Self-controlled (SC) feedback (Fb) has been shown to benefit motor learning for a variety of skills (Wulf, 2007). Motivation has been suggested as a possible mechanism beneath these effects (Chen, Hendrick, & Lidor, 2002). This study examined motivation (Intrinsic Motivation Inventory or IMI; Ryan, 1982; McCauley, Duncan, & Tammen, 1989) in SC and yoked (YK) Fb groups that learned a sequential timing task. The IMI was given four times during the study. Two subscales, Interest and Enjoyment (IE) and Perceived Competence (PC), were of primary interest. Correlation analyses examining relationships between those subscales and performance measures revealed significant results. In the SC group, pre-training PC was significantly and negatively correlated to absolute error in relative timing (AE_Rel) during the final block of practice (r = -0.540). Pre-training, mid-training, post-training, and post-study IE were significantly and negatively correlated with absolute constant error (ACE) during Transfer (r = -0.512, -0.659, -0.568, and -0.549 respectively). In addition, pre-training IE was significantly and negatively correlated with AE_Rel during the final block of practice and during Retention (r = -0.487 and -0.425, respectively). In the YK group, pre-training, mid-training, post-training, and post-study PC were significantly and positively correlated with ACE during Transfer (r = 0.537, 0.511, 0.510, and 0.517, respectively). In addition, pre-training, mid-training, post-training, and post-study PC were significantly and positively correlated to AE_Rel during Transfer (r = 0.677, 0.679, 0.609, and 0.560, respectively). For the SC group, higher levels of IE and PC

were associated with more accurate performance. For the YK group, however, higher levels of PC were associated with less accurate performance. These associations may offer support for the argument that self-control allows individuals to tailor feedback to their needs (Chiviacowsky & Wulf, 2002).

The effects of self-control and yoked feedback schedules on performance and motivation

Fairbrother, Jeffrey T.; Laughlin, David D.; Alami, Arya; University of Tennessee, Knoxville; Post, Phillip G.; New Mexico State University

Research suggests that allowing individuals to control the presentation of feedback during practice enhances learning (Janelle et al., 1997; Chen, Hendrick, & Lidor, 2002; Chiviacowsky & Wulf, 2002; Patterson & Carter, 2010). Such findings support a larger body of work detailing the benefits of self-controlled learning environments (Wulf, 2007). The mechanisms beneath these benefits, however, are not fully understood. Several researchers have suggested that self-controlled learning environments may work in part because they lead to increased motivation (Janelle et al., 1997; Chen, Hendrick, & Lidor, 2002). This study examined motivation (Intrinsic Motivation Inventory or IMI; Ryan, 1982; McCauley, Duncan, & Tammen, 1989) in self-control (SC) and yoked (YK) Fb groups. Participants learned a sequential timing task. The procedures replicated those reported by Chiviacowsky & Wulf (2002) with a few exceptions—acquisition trials were increased from 60 to 120, and the IMI was administered at four points throughout the study. Analyses revealed significant differences between self-control (SC) and yoked (YK) groups in performance and motivation scores. Typical SC effects emerged. During acquisition, SC and YK groups improved with respect to relative timing error ($p < 0.001$). The SC group, however, performed more accurately than the YK group in transfer testing with respect to both absolute constant error ($p = 0.013$) and relative timing error ($p = 0.036$). In addition, the SC group reported higher levels of intrinsic motivation than the YK group throughout the study ($p = 0.024$). The study provides further support for the advantages of self-controlled feedback. Additionally, the results from the IMI suggest that increased motivation may help explain the benefits of self-controlled feedback.

The effect of transcutaneous electrical nerve stimulation combined with mental practice to learn a novel fine motor skill

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Mental practice (MP) has been shown to enhance motor learning in both healthy populations and in persons with neurological disease (Clark 1960; Page et al 2005). MP activates sensory-motor areas in the brain which correlate strongly with activation patterns seen in the actual movement. Similarly, prolonged application of transcutaneous electrical nerve stimulation (TENS) can improve motor performance (Wu, 2006), an effect which is attributed to expanded cortical representations of stimulated muscles (Meesen et al., 2011). This project examined the effect of MP+TENS on acquisition of a novel fine motor skill. Seven college students were recruited to perform a modified 9-Hole Peg Test before and after the 5-day-long MP with or without TENS, followed by a retention test 72 hr afterward. A standardized MP instruction was used to guide MP; each MP session took approximately 15 min. Within each, 3 repetitions of mental rehearsal of the complete task were timed. Three subjects (the MP+TENS group) received 30 min of 100 Hz continuous TENS, 250-μs pulse

duration prior to and continuously throughout all MP trials. The results revealed that both groups significantly decreased their MT in performing the task after the mental practice ($p < .01$) suggesting that mental practice can facilitate learning a novel fine motor skill. However, the MP+TENS group spent significantly longer (~33%) in timed MP repetitions ($p < .001$), and their MP times were more approximate to the actual MT after the 5-day mental practice, suggesting they had acquired a more concrete mental representation for the movement. These findings suggest that TENS may enhance the quality of MP training and hasten acquisition of a novel movement skill. This could have valuable applications in both sports and rehabilitation as a safe adjunctive technique for motor learning.

Biological motion perception in tennis serves by using computer graphics: A comparison between successful and unsuccessful performance

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Skilled tennis players can predict ball direction even before the opponent's racket makes an impact with the ball. This superior anticipatory performance depends on the information available from the essential kinematics of the opponent's motion. Although research on such perceptual expertise is rapidly expanding, few studies have tried to identify the key factors that contribute to a successful anticipatory performance (e.g., Savelsbergh et al., 2005). To explore whether the anticipation strategy differs between successful and unsuccessful performances, this study investigates the interaction between visual search and biological-motion perception in tennis serves. Eleven skilled tennis players attempted to anticipate serve direction (center or wide) by observing three film types, namely, a live-action image, a polygonal model that showed the color and shape of the tennis server, and a point-light model that represented only the kinematics of the opponent's movement. The test films were occluded when the foot of the participants touched one of two mat-switches, and visual search behavior was measured using an eye-path tracking system. In all film conditions, the participants spent a significantly longer time viewing the head-shoulder area in the unsuccessful condition than in the successful condition. Moreover, they spent more time fixating on this area in the point-light condition than in the two other conditions. These results suggest that skilled tennis players use different anticipation strategies in successful and unsuccessful performances.

The influence of attentional focus on expert pattern perception in sport

Gorman, Adam D., Australian Institute of Sport & University of Queensland; Abernethy, Bruce, University of Queensland; Farrow, Damian, Victoria University & Australian Institute of Sport

The visual system is capable of encoding information in the visual array at a subconscious level of awareness (e.g., DeSchepper & Treisman, 1996), thereby demonstrating that the acquisition of perceptual information is not entirely dependent upon consciously focused attention (Fernandez-Duque & Thornton, 2000). Evidence has also shown that domain-specific experience may act to moderate the ability to extract information from a scene (Werner & Thies, 2000). For example, experts are able to encode complex information from a structured pattern amidst experimental conditions designed to substantially challenge their attentional resources (e.g., Charness, 1976; Garland & Barry, 1991, 1992). The

present study was designed to extend this research by examining the attentional level at which expert team-sport performers encode specific structural information from a complex and dynamic pattern of play. Expert and novice basketball players completed a series of recall tasks where they were asked to focus their attention on either the attacking or defending pattern structures before being asked to recall either the attended pattern elements (attended condition) or the unattended pattern elements (unattended condition). The results revealed that the experts were superior to the novices when recalling the attacking and defending pattern structures in both the attended and unattended conditions. In addition, while the novices exhibited a significant decline in performance when recalling the unattended attacking and defending patterns compared to in the attended condition, the experts were able to maintain their recall performance for the attacking structure across both conditions, suggesting that the locations of the attacking players may be an important feature for expert pattern perception (see also, Williams, Hodges, North, & Barton, 2006). The results highlight the remarkable capability of experts to encode pattern information from a complex and dynamic action sequence in the absence of focussed attention (see also, Memmert, 2009).

Collaborative internet environments and video-based observational practice facilitates retention of motor skills

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The nature of feedback required for optimal skill acquisition has been studied extensively. However, with the adaptation of Internet mediated social networking technologies in many educational settings, the way feedback can be delivered is changing. We investigated how manipulating the sources of feedback provided to learners within a social networking environment impacts the retention of clinical, technical skills. A custom social networking site was developed that allows a community of learners to access instructional demonstrations, communicate with an educator, and provide/receive feedback asynchronously. Participants in 3 groups of nursing students ($N = 36$) were videotaped performing a pre-test trial of a previously learned psychomotor skill (ventrogluteal injection) on a synthetic simulator. Each video was uploaded to a server. For the next 2 weeks learners in the "video group" could access an instructional video with an expert performing the skill on-line. Those in the "expert-feedback group" had access to the same instructional video; they could watch and evaluate their own performance, and received expert feedback on their performance. In addition, those in the "expert and peer-feedback group" could also provide and receive feedback to and from peer learners. All users returned for retention and transfer-tests (performing the same skill on a hybrid simulator). Pre, retention, and transfer-tests performances were evaluated using standardized checklists by experts. The pre- and retention-test analyses revealed significant interactions ($p = .026$), where only the retention-test performances of the expert and peer feedback group were rated as significantly better than pre-test. The transfer analyses revealed that those in the expert and peer feedback group performed better in transfer than those who participated in the video group ($p = .004$).

Effects of planning time on movement execution during a bimanual sequential grasping and placing task

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How people plan and execute their movements has been a central line of research in motor control. Although various studies have examined motor planning during unimanual movements, there has been little research into how participants plan their movements during object manipulation tasks that require the sequential use of both hands. The purpose of the present study was to examine movement execution strategies during a bimanual sequential grasping and placing task that require object rotation and height translation. The apparatus consisted of 2 height adjustable shelving units (15% and 85% of maximum reaching height) including 3 separated rectangular boxes. The task was to grasp an object from one of 4 start positions (left high/ left low, right high/ right low) with one hand, place it on either middle shelf, switch hands, grasp the object, and place it to one of 4 end positions (see start positions) presented on a screen. Participants were randomly assigned to one of two experimental groups: limited planning time group (n = 15) and (2) unlimited planning time group (n = 15). One experimental session included 120 trials in total, made up of 2 initial and final shelf heights (low to high/ high to low) 2 movement directions (left to right/ right to left) and 2 rotations (no rotation/ rotation). The results demonstrated that, participants planned their movements to afford comfortable end postures (i.e., the end-state comfort effect). However, depending on the amount of planning time, we observed noticeable differences in motor execution strategies. Participants with limited planning time showed shorter reaction times but longer movement times and 55% of these participants executed both object rotation and height translation with the final grasping hand (only 23% of participants with unlimited planning time chose that strategy). Based on these results, we postulate that limb selection during manual actions can be modified by particular task demands, and that the observed individual differences resulted from differences in how participants conceptualized and viewed the task.

Visual search strategies of the expert basketball referee

Han, Dong-Wook; Park, Dong-Jin; Chonbuk National University

The purpose of this study was to investigate the differences of visual search strategies and actual perceived eye-focus locations (APEL) on expertise levels of basketball referees. Participants (n = 12) were assigned to one of two groups defined by expertise levels, which consisted of 6 expert and 6 novice. The task was to press a keyboard and then say what violation occurred. To acquire the data of the eye movement, a NAC EMR-9 with 18 videos was used. Violation distance (far vs. near) and violation types (related to ball vs. not related to ball) were analyzed. The independent variables were expertise (2), violation distance (2) and violation types (2). The dependent variables were the decision-precision, the movement time, the eye fixation frequency, the ratio of fixation time, the average of fixation duration, the eye-focus locations, and APEL. The results were as follows: First, decision-precision scores were significantly higher as a referee is an expert, a violation occurs at near zone, and a violation situation is related to the ball. Second, the speed of referee's decision-making was significantly faster as a referee is an expert and a violation situation is related to the ball. Third, the eye fixation frequency was significantly higher as a violation situation happened at far distance compared with near distance. Fourth, the ratio of fixation time was lower as a referee is an expert and a violation situation occurs at a far distance. Fifth, the average of fixation duration was significantly lower as a referee is an expert, a violation happened at far distance, and a violation situation is not related to the ball. Sixth, as expert referees, they had the eye-focus locations on offensive players, but they had APEL on both offensive players and defensive players in total game. On the other hand, novice had both eye-focus location and APEL on offensive players. Seventh, as expert referees, they tended to synchronize both the eye-focus locations and APEL when a violation occurred.

Searching for the effective badminton "high clear" practice through the blended learning

Han, Dong-Wook, Chonbuk National University; Seo, Jung-Suk, Wonkwang University

The purpose of this study was to investigate the effect of the blended learning method on "High Clear" skill learning of badminton. Total 20 college students who take the badminton class were allocated to blended learning group (n = 10) and off-line group (n = 10). After a badminton class for 9 weeks, the class satisfaction, thought, opinion, and "High Clear" skill improvement were evaluated using a pre- and post-test method. The results were as follows: First, the extent of class satisfaction and "High Clear" skill improvement appears to be higher in the blended learning group than in off-line group. This result indicates that the blended learning may prevent the decrease in learning efficiency that occurred in the off-line class due to many students' participation. It appears that the effective allocation for the on-line or off-line class results in a similar learning effect, even though the students don't perform any physical activity. Second, it seems that the general thought and opinion for the class was positive in both the blended learning group and the off-line group. In particular, the students who learned the "High Clear" skill through a blended learning method were very affirmative of the effect of the on-line class. Finally, we suggest that the blended learning strategies may solve the safety problem that occurred due to the large numbers of students and the narrowness of the practice space in the badminton class, and be helpful in improving motor skill even without actual physical activity.

Maintaining offline improvements during procedural learning despite interference from spatially similar procedural task practice

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We have shown that interference, occurring within 2 hr of original procedural learning, did not eliminate offline improvements if the interfering sequence task resembled the spatial layout of the target sequence. Based on Hikosaka (1999) we did not anticipate the presence of offline improvements when interference was created with a task that had the same motor structure (i.e., same string of finger presses) as the to-be-learned task because motor codes are assumed to develop later in practice. Because of the relative simplicity of the sequences being learned we assumed both spatial and motor codes had formed, thus supporting offline benefits despite either form of interference. To examine this account we had subjects practice longer sequences for the same amount of practice assuming that this targeted an earlier point in the learning process where spatial codes would be most critical. Practice of a 7-key sequence with the left hand was followed by additional practice with one of three interfering tasks, (a) a novel sequence with no relationship to the to-be-learned task executed with the right hand, (b) a spatial task involving the same sequence of keys (changing the order of fingers used) executed with their right hand, and (c) a motor task involving the same sequence of finger presses (by changing the spatial location order) executed with the right hand. Practice trials were 30 s in length followed by 30 s of rest. Twelve trials of practice of the to-be-learned sequence were followed immediately by 12 trials of the interfering task. Three additional trials of the to-be-learned sequence were performed 24 hr later. Offline learning following spatial interference was similar to that observed in the no-interference condition. Motor interference supported a small offline benefit beyond the novel interference task. Moreover, performance of the spatial interference task was consistent with the development of a spatial code. These data question the notion that practice of an alternative task shortly after target task practice eliminates offline benefits.

Effects of attentional focus on the kinematics of a golf putting task

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The influence of attentional focus (AF) on the learning and performance of motor skills has been examined with the results generally supporting a greater effectiveness for an external focus of attention (Wulf, 2007). However, a few studies have found support for an internal focus of attention (Perkins-Ceccato et al., 2003). Most of the research used product measures (e.g., accuracy), with few studies measuring the effects of AF on the processes (e.g., kinematics) associated with the movements (Southard, 2011). The purpose of this study was to examine the effects of AF, on the displacement and velocity of the club head in a golf-putting task. College-age adults ($N = 20$) putted a golf ball to a hole 1.5 m away. Each participate completed 10 trials using an external focus and 10 trials using an internal focus. The order of the AF was counterbalanced among the subjects. For the internal focus, the participants were asked to focus on the movement of their hands and arms, while for the external focus they were instructed to focus on the movement of the head of the putter. Participants were reminded of the AF before each trial, and compliance checks were made following each testing session. Each trial was videotaped, and the movement of the club head was analyzed. Average linear displacement and velocity were calculated. Additionally, average standard deviations of the trials in each AF were calculated to provide a measure of variability for displacement and velocity. The data were analyzed using a 2×4 (Focus $\times$ Measure) repeated measures MANOVA. The results indicated no significant differences between the AF for any of the dependent measures, $p > .05$. The results of this study indicate that there is no difference between the two AF on kinematic measures. These results are in agreement with some of the research based on outcome measures using golf putting tasks (Poolton et al., 2006). However, the results are inconsistent with the results of Southard (2011). These differing results may be explained by the nature of the task (e.g., slow putting vs. ballistic throwing).

Movement excursion explains associations between gross and fine motor functions in older adults with and without Parkinson's disease

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Parkinson's disease (PD) affects tasks requiring gross and fine motor skills. The relationships between performances on these tasks and between execution of these tasks and disease severity as expressed by the Unified Parkinson's Disease Rating Scale III (UPDRS-III) were explored to better understand degenerative effects of the disorder. Twenty-six individuals with PD (ages: 51-83, $M = 66$ and disease severity from I-III Hoehn & Yahr stage) and nine older adults (ages 61-76, $M = 66$) participated in the study. Fine motor skill measures included data from two size matching handwriting tests: stroke length (SL), stroke movement time (MT), peak velocity (PV), and normalized jerk (NJ) for 15 mm and 20 mm. Gross motor skill measures included the timed-up-and-go (TUG), dynamic gait index (DGI), 6-min walk (6MW), knee joint strength (flexion/extension), and standing balance with eyes open (area and velocity of center of pressure (COP) measurements). Significant correlations for the UPDRS-III with the 20mmSL, 20mmPV, TUG, 6MW, COPvelocity, COParea, and DGI existed. PD participants with greater symptom severity spent more time on the TUG, covered less distance on the 6MW, scored lower (poorer performance) on the DGI, had greater COPvelocity and COParea, and wrote smaller with a lower PV at 20 mm. In addition participants who produced smaller SL at 20 mm scored lower on the

DGI and spent more time on the TUG, while those who wrote with a smaller PV at 20 mm covered less distance on the 6MW. No significant correlations with MT were observed for writing. Analyses revealed that older adults approximated the requested writing sizes. PD participants approximated the 15 mm size but wrote smaller than the 20 mm size. These results show that deteriorations in fine and gross motor functions correspond to each other and to PD symptom severity. However, although execution time and movement excursion correspond to gross motor skill function, it is primarily movement excursion and not execution time that corresponds to impaired fine motor skill function.

Exploring the impact of no-vision on practicing a hoop throwing task

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Rhythmic gymnastics is characterized with strength and beauty while operating with apparatuses to perform all the skills. The throw techniques are one of the fundamental skills in rhythmic gymnastics, and developing the perfect throw techniques has always been an important issue in the training program. Proprioception of the throwing arm provides important information for controlling the throwing task. However, the overpowering nature of the vision often masks the proprioceptive information. By removing the use of vision when practicing the throw act it may be possible that the proprioception of the throwing movement can be enhanced therefore improves the performance. The purpose of the study was to investigate the effectiveness of using a no-vision practice condition in hoop throwing task. Two experiments were conducted. Exp 1 examined 4 elite rhythmic gymnasts who practiced the hoop throwing task without vision for 12 sessions. Exp 2 examined 16 female college PE students who were randomly assigned to vision and no-vision practice groups also practiced for 12 sessions. The performance outcome and movement kinematics of the throwing performance were analyzed. The results showed that for the performance outcome, post-tests were better than pre-tests in both experiments. For the novice learners, the performance of the vision group was better than that of the no-vision group in post-tests. For the movement kinematics, the elite gymnasts showed no difference in the shoulder movement after no-vision practice whereas elbow joint movements were more stable after the practice. The wrist joint movements of the elites were more stable in the no-vision condition compared to the vision condition. For the novice learners, the shoulder and elbow joints movement improved after practice for both conditions; however, the wrist joint movements were more stable for the no-vision practice group. In conclusion, no-vision practice condition facilitated the performance of hoop throwing task. No-vision training provided a more sensitive condition for the control of the throwing arm.

The contribution of internal forward model on online correction during interceptive action

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Movement correction during interception is fundamental skill in fast ball sports. The key role of prior expectation or internal forward models as the principal source of information for guiding interception has been emphasized (Zago et al., 2009). Recently, Makoshi et al. (2011) reported that transcranial magnetic stimulation (TMS) delivered over the supplementary motor area (SMA) before the onset of the movement, affects the internal forward model. The aim of this study was to clarify the contribution of the internal forward model to interceptive movement correction by investigating the influence of the TMS

delivered over the SMA, before movement onset; this was done for interceptive movement correction in various contexts with prior expectation of target velocity. Participants (n = 11) intercepted, with elbow extension, the virtual moving target that had two velocities (4 and 8 m/s). To manipulate prior expectation, different probabilities of the occurrence of each target velocity were used (i.e., 20, 50, and 80%). The result showed significantly higher temporal error in situations with uncertainty (i.e., 20 and 50%) with TMS than that without TMS regardless of the target velocity ($p < .01$, $\chi^2 = .51$). In addition, participants showed a marked decrease in movement velocity for correct the movement upon the delivery of the TMS. These results show that the TMS delivered over the SMA before onset of movement, disrupted the interceptive movement correction. Thus, present research further evidences the fact that the online interceptive correction is mediated by the internal forward model. It has been reported that the efference copy included in the internal forward model is compared with actual sensory signals to rapidly update the movement and achieve the desired online movement correction (Leonard et al., 2011). Accordingly, the results suggest that the interception was corrected by comparing the predictive sensory signal before the movement onset and the actual sensory signal during the movement, and the TMS disrupted these processes.

Post-training meditation mediates motor memory consolidation

Immink, Maarten A.; University of South Australia

Night-time and day-time sleep support motor memory consolidation through memory stabilization and off-line learning processes. Certain meditation states may share common features with sleep or support unique processes that promote motor memory consolidation. For example, neuroimaging studies of Yoga Nidra meditation states report increased cerebral activity associated with motor related attention, planning and imagery and also increased ventral striatum dopamine release. The present aim was to determine if exposure to post-training Yoga Nidra facilitates motor memory consolidation. Twelve right-handed adult participants residing at a yoga academy and with a mean of nine years meditation experience were trained on four-element discreet sequence pressing task variations at 8:00. At 12:00, participants either completed a 30-min bout of Yoga Nidra or completed 30 min of cooking or cleaning duties. A test involving trained and novel sequences was completed at 17:00. The Yoga Nidra group demonstrated significantly faster reaction time and movement time test performance on trained sequences but there were no group performance differences for novel sequences. For trained sequences, post-training Yoga Nidra resulted in maintenance of performance levels achieved at the end of training while those not exposed to Yoga Nidra exhibited performance deficits equivalent to the level of novel sequence performance. Therefore, these data suggest that post-training Yoga Nidra meditation promotes motor memory stabilization but not off-line learning and that memory stabilization is sequence specific as opposed to being task specific. These findings represent the first demonstration of meditation mediated motor memory consolidation and extend previous neuroimaging work on Yoga Nidra to motor skill learning. More generally, these results have relevance for sleep-dependent memory consolidation and are also consistent with a growing body of literature demonstrating that regular meditation benefits cognitive function.

A pilot randomized controlled trial of yoga therapy supplemented exercise interventions for motor function and quality of life outcomes in patients with chronic post-stroke hemiparesis

Immink, Maarten A.; Chan, Weili; Hillier, Susan; University of South Australia

This pilot randomized controlled trial (RCT) evaluated the benefit of supplementing exercise interventions with yoga therapy for motor function and quality of life outcomes in patients with chronic post-stroke hemiparesis. Activity limitations associated with hemiparesis may mean that exercise interventions provide limited benefits for daily activities and independent living. Inclusion of yoga may provide focused motor and sensory training as well as stress reduction benefits. 14 patients were randomized to either an exercise only ($N = 6$) or an exercise and yoga ($N = 8$) intervention. The exercise intervention component involved 6 weekly 1-hr sessions of strength, balance and aerobic adapted exercises. The yoga therapy complement involved 6 weekly 90-min group classes and daily 40-min home practice involving gentle yoga movement, breathing exercises and meditation. Balance, gait and functional performance outcomes and Stroke Impact Score (SIS) domains were assessed at baseline and post-intervention. No group differences for motor outcomes were evident at post-intervention accounting for baseline scores. SIS analysis only revealed a significant effect for the physical domain with higher scores for patients in the yoga and exercise intervention. While complementing exercise with yoga did not appear to have a clear benefit for motor function outcomes, there was evidence that patients receiving both intervention modalities did perceive larger improvements in motor function. Higher perception of personal improvements in physical function for patients receiving exercise and yoga may have been based on participation in activities of daily living. The small sample size of this study does not allow for reliable conclusions with regard to motor function and quality of life benefits gained by supplementing exercise with yoga for chronic post-stroke hemiparesis populations. This pilot RCT does demonstrate that appropriately prescribed exercise and yoga interventions are safe and enjoyable for individuals who have chronic post-stroke hemiparesis.

A comparative trial of lecture, online lesson and blended modes of teaching motor learning and control theory

Immink, Maarten A., University of South Australia

The aim of this study was to evaluate learning outcomes and student perceptions of learning preferences from lecture, online lesson and blended modes of theory delivery for in a university undergraduate motor learning and control course. The week prior to commencing a sensorimotor system module, 32 volunteer students completed baseline assessment of theory knowledge and a questionnaire of learning preferences. For the week of the module, participants were randomly allocated to receive either face-to-face lectures, Moodle based lessons or a blend of both modes as the primary means of content exposure. The week following the module, students were tested with novel assessment questions and completed a follow-up questionnaire on perceptions of learning preferences. The data indicate no group differences in academic performance changes although all three groups exhibited significant improvements on assessment scores. Mean scores for perceptions that online lessons increase learning engagement and that lectures are convenient for learning content significantly increased from baseline. Scores for perceptions that online lessons provided

equivalent learning to lectures and that learning could be improved through the provision of more online lessons significantly increased for the lesson and blended mode groups but not the lecture group. These data suggest that online lessons provide comparable gains in motor learning and control theory to lectures and that although students prefer blended modes of learning, combining lectures and online lessons does not provide additional academic gains. Exposure to online lessons increases students' preferences for this mode of learning although lectures are viewed as being more convenient. Larger comparative trials across longer learning periods are needed to further assess the most effective and sustainable teaching modes for motor learning and control theory at the undergraduate level.

Eye-Head coordination while rebounding the basketball under 3-on-3 situations

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Rebounding the basketball is an essential key factor to win the game. The basketball player, therefore, is required both to percept the temporal and spatial information through the visual field and to react to the opponent player immediately. Our previous study showed experienced players utilized the properties of ambient vision system immediately for receiving visual information broadly in order to coordinate ahead of the shooter and the opponent player actions in 3-on-3 situations. The purpose of this study, therefore, was to examine visual search behavior and head movement of experienced basketball players when they rebound the basketball by using an eye-movement registration system in order to understand the mechanism of perception-action coupling. Seven male players with athletic career ranging from 8 to 12 years (mean ± *SD*: 9.70 ± 1.50 years) were participated in this experiment. Subject's experimental task was to box-out (i.e., block) the opponent offensive player under the 3 randomized tactical plays 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 3 video cameras (S21, Canon, 30 Hz). All video recordings were synchronized with the eye movement data. The results showed that experienced players were able to react to the opponent player before the shooter's ball release timing quickly not only without movement of the head but also with small distribution of viewing angle around origin during moving phase. This experienced players' behavior was identified under all 3 tactical plays. Furthermore, experienced players moved around critical area and had different fixation locations and visual search patterns whether they were moving or not. Therefore, constant visual fixation behaviors and head movement in the complex tactical environments was effective to react the opponent quickly to increase the chance of rebounding the basketball.

The relationship between response time and EEG frequency in lateralized mental rotation of model imagery

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This study investigated how the comparison of the poses of two figures, which were laterally rotated at several different angles, influences the response time for the judgment of whether their poses were the same and the EEG frequency. The figures were rotated clockwise by 0° (facing angle), 60°, 120°, 180°, 240°, and 300°. Eighteen university students performed the following tasks in an experiment: the front or back view (rotated at 0° and 180° respectively)

of a wooden jointed doll was first presented for 3 s as the base stimulus, and the doll was then presented in another pose. The participants were required to judge accurately and as fast as possible whether the poses were the same. The EEG was registered according to the international 10-20 electrode system; signals were recorded from Fp1, Fp2, F3, F4, C3, C4, P3, and P4. We used the data of the reaction time and EEG when the angle of difference between the two dolls was 0° and 180°. The results showed that the reaction time when the angle of difference was 0° was lower than it was when the angle of difference was 180°. The results of the EEG showed that the potential of the right hemisphere was larger than that of the left hemisphere and that the potential of Fp1 and Fp2 was larger than that of the other positions. These results indicate that the participants laterally rotated the mental image of the doll's figure in the same way as participants of other studies had rotated geometrical figures. Consequently, this study suggests that the activation of the right hemisphere and forehead was concerned with the judgment of correspondence or non-correspondence in spatial compatibility tasks with prior presentation of stimuli.

Brief hypnotic intervention enhances throwing accuracy

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Studies have demonstrated that performance can be improved by direct suggestion during a state of physical relaxation and focused attention following hypnotic induction (e.g., Barker & Jones, 2006). The present study examined whether motor skill learning could be enhanced through a hypnotic intervention. The task involved throwing a tennis ball overhand at a target. Participants were randomly assigned to either a hypnosis or control group. Both groups first completed a pre-test of 20 throws. Prior to the second block of 20 throws (post-test), the hypnosis group received a 10-min hypnotic intervention. The theme of the hypnosis session was to focus on the target while throwing, as studies have demonstrated that movement accuracy can be enhanced by adopting an external focus on the target (Wulf, 2007). Participants were aroused from the hypnotic state prior to the throwing task. The control group was asked to relax in the same environment for the same length of time prior to the post-test. Control group participants were told that focusing on the target has been shown to increase accuracy. On the post-test, the hypnosis group showed an increase in throwing accuracy relative to the pre-test and more effective performance than the control group whose performance was similar to that on the pre-test. On a retention test (20 throws) conducted 5-8 days after the post-test, the hypnosis group again demonstrated greater throwing accuracy than the control group. These findings show that hypnosis can have a positive impact on motor learning. Potential mechanisms for this effect will be discussed and may include enhanced self-efficacy and outcome expectations, deepened relaxation, and heightened attentional focus.

Does auditory stimulation effect gait variability in healthy elderly?

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Introduction: Human movement is variable in nature, with the variability depending on the task. With regards to gait, research has shown that aging negatively affects gait and the elderly tend to adopt a more conservative gait pattern. Considering that gait variability was shown to be a strong predictor of pathology and falls during gait, such an assessment seems very important for the elderly population. Previously investigators have used auditory stimulation as a way to improve gait. We aimed to determine if there were significant linear and quadratic trends in gait variability in healthy elderly walking at their self-selected

pace to four auditory conditions. Methods: Data was collected from 27 healthy elderly for five min of treadmill walking. The four auditory conditions were white noise, no noise, chaotic music, and metronome. The coefficient of variation (CoV; a measure of the amount of variability) and the detrended fluctuation analysis (DFA) (a measure of the temporal structure of variability) were used to investigate the trends present in the stride interval, stride length, and step width from 150 continuous strides. Results: The CoV did not show significance for any of the parameters for either linear and quadratic tends. DFA did not show significance for the linear trend for the parameters. However, DFA did have significant quadratic trends for stride interval ($p < 0.001$), stride length ($p < 0.05$), and step width ($p < 0.01$). Conclusions: From the results we conclude the nonlinear analysis of DFA was the only one sensitive in isolating the trend. The quadratic trend of the temporal structure of variability was the only trend that displayed significance. Within the three gait parameters the chaotic music displayed the highest alpha value, followed by the no noise condition. We speculate that walking to a stimulus that is chaotic in nature may be beneficial. These results resemble the U-shaped optimality of movement variability hypothesis proposed by Stergiou and colleagues, where the optimal variability in movement is one that is chaotic in nature.

Social constraints on group coordination: Effects of team membership

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A common feature of many social activities such as friends walking together, a concert audience swaying to music, or a competitive rowing team racing down a river, is the synchrony that occurs between the movements of the actors involved. Although the magnitude or stability of such movement coordination can differ across social situations, it is a natural part of social behavior and can result both intentionally due to intrinsic task requirements (i.e., rowing) and spontaneously (i.e., friends walking together) due to the myriad of perceptual-motor couplings that exist during social interaction. However, while social movement coordination often occurs between 3 or more individuals, most research has only focused on two-person, 'interpersonal coordination', and very little is known about the dynamics of broader social, group, team or multi-person movement coordination. Here we will present data from a study investigating (a) the dynamic stabilities of multi-person coordination and (b) how minimal group (team) membership influences these dynamics. Groups of 3 or 4 participants played a virtual running game in which each participant moved a stimulus (dot) around a circular track presented on a 50" display monitor. Each participant held a magnetic motion tracking sensor to control the movements of their stimuli and viewed the stimulus movements of themselves and the other participants on their own display monitor. Team membership was manipulated by having 1, 2 or 3 of the dots colored blue and the remaining dots colored red. The patterning and strength of the coordination that occurred between pairs of individuals and the group as a whole was determined using a cluster phase analysis. Results revealed that participants became spontaneously coordinated in predictable lead/lag relationships and that implicit team membership produced asymmetries in the stability of between person coordination and the coordination of the group as a whole. Implications of the findings and methodology used for understanding the social dynamics of team movement coordination are discussed.

Action-Target congruency effects during active versus passive movements

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Action experiences can affect perception, such that visual discrimination can be facilitated or inhibited during congruent or incongruent actions. Miall et al. (2006) showed that response times to targets were faster when congruent movements were simultaneously enacted, arguing that predictive processes facilitated cognitive processes associated with target discrimination. We evaluated motor- visual priming under Active and Passive movement conditions (elbow flexion and extension) during a target discrimination task. Participants (n = 12) watched a computer-generated hand that moved in a Predictable (from flexion to extension) or Unpredictable (random) sequence. When the target hand changed colour, participants responded vocally as fast as possible. The target would appear in a position congruent or incongruent to the participant's actual hand. RTs were faster when the stimulus was Predictable ($p < .001$), mostly due to differences in the Active condition ($p < .01$). RTs were generally faster during Passive movements ($p = .08$). There was a trend ($p = .10$) for RTs to be faster for congruent positions when the stimulus was Unpredictable. When the stimulus was Predictable RTs were generally faster for incongruent targets. We attributed this incongruent target advantage to a saliency effect associated with the target appearing to jump to a new location (facilitating detection of stimulus change). However, for the Unpredictable conditions, faster RTs for the congruent targets (Active = 12 ms; Passive = 5 ms) suggest that visual attention is drawn to the hand (Thomascheke et al., 2011). Because the RT differences were larger in the Active condition (we also observed RT differences of 30 ms in a previous study), facilitation could be related to forward predictive processes that co- occur with action commands. These data support the proposal that motor-visual facilitation is a product of motor control processes. There is evidence that these effects are more pronounced under active vs. passive conditions implicating forward processes.

Modulation of the timing of expert baseball batter's hitting movement in an in-situ setting

Kato, Takaaki; Nagano, Tomohisa; Keio University

Successful hitting a baseball requires not just a powerful, but also appropriate temporally coordinated hitting movement relative to the pitcher's kinematic motion and the pitch's flight. In this study, we analyzed the temporal parameters of batter's eye and body movements using the pitching machine actually simulate the live pitcher via a HD video screen. In particular, we focused on how expert batters modulate the timing of the hitting movement during the preparatory phase of batting in an in-situ setting. Ten experienced baseball batters (including two players had been named to top prospects in Japanese collegiate baseball league) were asked to hit the real pitches (the average velocities was 34.4 m/s) projected by the ball machine which were synchronized with the pitcher's motion with variety of pitching phase durations (very long, long, short, and very short). After sufficient practice, 32 swings were filmed by 3 high-speed cameras (Casio Computer Co., Ltd., EX-F1, 300 Hz) in order to analyze temporal hitting parameters that were defined by seven events and six phases (Shaffer, et al., 1993). Also, their visual search behavior was examined using an eye movement registration system (Nac Image Technology Inc., EMR-9). During the wind-up and pre-swing phases of batters, the timing of stepping with a front foot and shifting weight forward was modulated relative to pitcher's motion. The durations of early,

middle, and late swing phases of batters were comparatively stable regardless of influence of pitcher's kinematics. When the pitcher intentionally took very longer or shorter time in second early coking phase, the batters performed higher scores than at other situations. Good hitters were appeared to start a swing slowly coupling to the pitcher's motion with the short duration of the bat-swing, and moved their eyes predictably, and used a systematic visual search strategy. The authors also highlight the opportunity to examine some aspects of expert batter's behaviors in the good external and ecological validity.

A distal focus of attention is preferred, and leads to superior performance in a golf putting task

Kearney, Phil E., University of Chichester

Previous research into attentional focus in golf has indicated that, in a pitching task, a proximal external focus of attention is most effective for novice golfers (Wulf, McNevin, Fuchs, Ritter, & Toole, 2000), while a distal external focus of attention is most effective for experienced golfers (Bell & Hardy, 2009). The present research investigated if a less complex golfing task (putting) would demonstrate a similar advantage for a proximal focus of attention in novice golfers. Following familiarization with the task, general putting technique, and the concept of attentional focus, eighteen participants completed three sets of 15 putts in a counterbalanced, within participant design, adopting a different focus of attention for each set (internal, proximal external, distal external). Following each set of five putts, participants were asked to answer three questions addressing their focus upon internal, proximal or distal cues. On the completion of the trials, participants were asked to identify if they had a preference for one or other focus. Friedman's ANOVAs indicated significant differences in the self-reports of attentional focus, suggesting that participants adhered to the three instructional conditions. A repeated measures ANOVA indicated that performance in the distal focus condition was significantly better than performance in the proximal or internal conditions (p's < 0.05), which did not differ. Results indicated that significantly more participants preferred a distal focus of attention than would be expected by chance ($\chi^2 = 6.33$, $p < 0.05$). In agreement with previous research, support for the benefit of an external focus of attention was found. In addition, results indicated that task complexity may be an important variable in the selection of the optimal external focus of attention for novices, as in contrast to some previous research, a distal focus of attention was found to produce superior performance. Caution is required with this interpretation, however, as participant preference may be a confounding variable.

Effects of rTMS on the complexity of arm-posture tremor

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The present study investigates the change in the complexity in upper extremity postural control with respect to the application of rTMS stimulus. The human movement system is complex due to the high numbers of components, and human motor behavior is typically a result of interactions between complex systems. In recent research, a nonlinear dynamics approach has been employed to investigate the phenomena resulting from a change in the complexity. The purpose of this study, therefore, is to investigate how excitatory changes in the cortex using rTMS affect the complexity of the motor system by means of a nonlinear analysis. Six healthy adults were recruited and were instructed to perform a sustained upper

extremity posture. The task involved pointing to a target located in front of the subject at a distance of 2 m while holding 75-cm-long stick. They were instructed to sustain the arm posture with the stick for 60 s while keeping as stable as possible and to point at the target with the tip of the stick as accurately as possible. 3D motion capture system was used to capture the position of markers attached at the finger, wrist, elbow, shoulder, as well as the endpoint of the stick. rTMS was applied to the hand area of the motor cortex at 1 Hz with 100% intensity. All participants performed the task before and after rTMS stimulus in seven-day intervals, and all conditions were randomized. Data was processed and analyzed with nonlinear methods. Phase synchrony data for the body segments and the endpoint of the stick were calculated to show the complexity of the motor system. The result showed that the complexity in the motor system decreased and that the phase synchrony increased within the main segments. This result suggests that a change in the neural activity according to rTMS stimulus causes a change in the complexity of the motor system. This research was supported by Basic Science Research Program through the National Research Foundation of Korea funded by the Ministry of Education, Science and Technology (2010-0021103).

How can involuntary movements of the arm in golf be detected?

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Yips affects putting performance in golf and can have both a neurological and a psychological origin (Smith et al., 2000). Diagnostics of these origins have not been reported yet, although they are fundamental for a better understanding and the treatment of yips. The present study examines how yips can be diagnosed by measuring muscle activity and putting accuracy. In a laboratory, 20 yips-affected and 20 non-affected golfers were asked to perform in total 75 putts from a distance of 1.5 m. They putted in five counterbalanced conditions being in line with the rationale of yips' possible etiologies: (1) the control condition consisted of putting as usual, (2) pressure was induced by noise from an audience, a video camera and the risk of monetary loss, (3) participants had to putt with one arm, (4) a floorball racket was used as a putter, (5) Latex gloves by means of a sensory trick had to be worn while putting. A repeated-measures MANOVA showed only a significant main effect of condition on muscle activity, $F(24, 8) = 5.64$, $p = .008$, $\eta^2 = .94$. A repeated measures ANOVA revealed a significant main effect of condition on putting accuracy, $F(2.50, 94.89) = 6.20$, $p = .001$, $\eta^2 = .14$, and a significant interaction effect between condition and group, $F(2.50, 94.89) = 6.86$, $p = .001$, $\eta^2 = .15$, which is due to the significant difference of the one arm (3) and the control condition (1), $F(1, 38) = 12.90$, $p = .001$, $\eta^2 = .25$. A simple t-test revealed that the yips group putted significantly less accurately in the one arm condition than the other group, $t(31.02) = 3.07$, $p = .004$, $d = .97$. In summary, the comparison of the putting performance between the usual putting and using only the dominant arm seems to be sensitive in detecting yips-affected golfers. In contrast, muscle activity could not distinguish between affected and non-affected golfers, presumably due to the multiple yips' etiologies. Future investigations may consider kinematics of the putter or wrist as a more reliable indicator.

Effects of disparity of model's and observer's viewing direction on visuomotor imitation

Krause, Daniel; Kobow, Sven; University of Paderborn

Mental rotation effects have been studied for discrimination tasks with stimulus pairs of abstract cube figures and humanoid postures (Amorim et al., 2006). An increasing

orientation difference of stimuli pairs is associated with increasing response times and errors. Mental rotation tasks and the planning of hand movements show considerable interference (Wohlschläger, 2001). Brain imaging studies support these results by showing that mental rotation and movement planning involve common brain areas (Kosslyn et al., 1998). We assume that spatial disparity of observer's and model's viewing direction (model-observer-disparity) demands mental rotation processes to solve the correspondence problem in visuomotor imitation. We investigated the effects of model-observer-disparity on imitation of 2 types of elbow extension-flexion movements (task 1: 1 reversal; task 2: 3 reversals). 16 female students had to imitate an avatar performing these tasks with varied locations of reversals and movement velocities. Both tasks were presented in 6 different orientations in pseudo-randomized order. The subjects were instructed to imitate each presented movement (432 trials) concerning the angle at reversals and velocity. Their arm was located on a lever with a rotary potentiometer. Our results show a main effect of orientation for the absolute error of angle at reversals (AE-angle), $p = .022$; $\eta^2 = .22$, and movement velocity (RMSE), $p = .020$; $\eta^2 = .20$, for both type of tasks. Post-hoc analysis indicates that the 0-degree-orientation shows lower errors for AE-angle than all other orientations, $p <= .008$; $1.39 > d > 0.76$. For velocity, the 180-degree-orientation shows higher RMSE than all other orientations, $p <= .030$; $0.87 > d > 0.55$, except 120-degree-orientation, $p = .087$; $d = 0.46$. Regarding the disparity of observer's and model's viewing directions, movement imitation seems to be dependent on stimulus orientation. The effects are in line with the assumption of mental rotation processes. Orientation dependent ideomotor effects may be an additional factor (Jackson et al., 2006).

The validity of multiple-repeated dual-task tests to estimate the level of motor skill automaticity

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Dual-task testing is widely accepted as a behavioral paradigm to assess automaticity of motor skills (Abernethy, 2001). By instructing to prioritize one of the tasks, the occurring dual-task costs (DTC) in the other task can be meaningfully interpreted. Repeated dual-task execution can reduce DTC. The resulting reduction of DTC can be caused by different mechanisms (Ruthruff et al., 2006). One possibility is automatization characterized by reduced attentional demands in motor control. An alternative possibility is task integration: subjects learn to efficiently integrate performance of the specific task pair (Blischke, 2000). The goal of the present study was to differentiate between efficiently integrated performances of a task pair as a consequence of multiple repeated dual-task tests and automatization of individual tasks as a consequence of extensive motor skill practice. 10 subjects practiced an elbow-extension-flexion sequence with three movement reversals and should perform the task as precise and as fast as possible (460 trials; distributed over 6 sessions). Feedback for movement reversals and time was provided after every second trial. In pre-tests, at the beginning of each session and in one retention test, the movement task and a visual-spatial 2-back task were tested under single- and dual-task conditions (6 trials each) with instructed priority for the 2-back task (multiple-repeated). For testing context-specific DTC reduction, a transfer dual-task test (single-repeated: pretest and retention) with a visual-spatial Sternberg-task was conducted. The results indicate a context-specific reduction of DTC since the 2 (test: pretest; retention) × 2 (cognitive load: single-task; dual-task) ANOVA shows a significant reduction for the multiple-repeated 2-back test, $F(1, 9) = 13.85$; $p = .010$; $\eta^2 =$

.61, while this is not the case for the respective ANOVA for the single-repeated Sternberg-test, $F(1, 9) < 0.01$; $p > .999$; $\eta^2 < .01$. Therefore multiple-repeated dual-task tests should be considered with caution if automaticity is the construct of interest.

Postural activity, motion sickness, and symptom severity among passengers and drivers in a virtual vehicle

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We investigated motion sickness and postural activity while sitting participants driving or watching a virtual vehicle. Thirty-nine healthy adults (20 male and 19 female, 20.7 1.8 years, 166.49 8.7 height) formed 20 passenger-driver dyads. Forza motorsport 3 in X-Box 360 (Microsoft, Corp.) was used as a virtual vehicle. Participants sat 105 cm away from a 55 inches LED monitor and kept their sight 60 deg horizontal and 48 deg vertical with the monitor. Two receivers of a magnetic tracking system (Flock of Birds, Ascension Technologies, Inc., Burlington, VT) were attached to a bicycle helmet and the skin at the 7th cervical vertebra of the participants to record their postural movement at 40 Hz. The test lasted up to 40 min. Participants filled out the Simulator Sickness Questionnaire (SSQ) before and after exposure to the game. According to a yes / no self-reported question of motion sickness, participants were divided into the Well group and the Sick group. Eight of 20 drivers (40%) and 11 of 19 passengers (55%) reported motion sick. The Mann-Whitney test of the SSQ scores indicated that in post-exposure, the Sick group had higher SSQ scores than that of the Well group. Wilcoxon signed ranks test indicated higher post-exposure SSQ scores in all passengers and the sick drivers as compared to the pre-exposure scores. A 2 (Role: driver and passenger) 2 (Condition: sick and well) 3 (Time: W1, W2 and W3) mixed design 3 way ANOVA showed a significant Condition by Time effect in the ML (mediolateral) direction of the torso movement. The Time effects were significant in both the AP (anterior-posterior) and ML directions in the head and torso movements, $p < .05$. Symptom severity increased as the passengers and the sick drivers exposure to a virtual vehicle. The positional variability increased as time. Compared to the Well group, the Sick group showed higher positional variability in the ML direction of torso movement before the onset of motion sickness, which supported the postural instability theory of motion sickness (Riccio & Stoffregen, 1991).

The joint Simon effect observed in a non-collaborative task: A response-discrimination account

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Using a classical Simon task, Sebanz et al. (2003) examined co-representation by pairing participants and assigning them to one of the two stimulus-response (S-R) alternatives. In this social context, performance was comparable to that of someone responsible for both S-R alternatives in the same Simon task alone. Of particular significance was the absence of this effect when participants performed the identical task alone. These results have been attributed to the tendency for one to represent another person's task despite the irrelevance of the other person's actions to the task. The aim of this study was to determine if the joint Simon effect (SE) could be elicited by spatially discriminating the alternative response location. It has been shown that the SE can be elicited in a go/no-go task when the go response is discriminated from a response at an alternative location (Ansorge & Wühr,

2004). Based on these findings, we introduced two novel tasks, in addition to Sebanz et al.'s original joint action (JA) task. In the JO task, the partner initiated each trial with the response key on the opposite side to that used by the participant to respond. In this condition, the alternative response was discriminated from the other and potentially recognized as functional to the task, affording a representation in terms of left-right spatial codes. In JS task, the partner initiated each trial with the same key used by the participant to make a response. In this condition, the potential response alternative was presumably not made salient to the participant. We found a significant joint SE in the group condition but not in the individual condition for both the JA and JO tasks. Response times were faster when the target and response corresponded spatially. In the JS task, the joint SE was not significant in both group and individual conditions. These results suggest that the joint SE can arise when two individuals participate in independent tasks because spatial codes are available to represent the alternative responses should those spatial response features be discriminated.

Effects of balance confidence on trunk sway during stance and gait tasks

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As low balance confidence is frequently reported in older adults, there is a need to better understand its effects on balance control. The measurement of task duration and trunk sway during a series of stance and gait tasks has been effectively used to identify specific tasks and measures that best discriminate normal and pathological balance control. The purpose of this study was 1) to examine the effects of low balance confidence in older adults on duration and trunk sway measures during stance and gait tasks, and 2) to determine which tasks and measures best discriminate older adults with low balance confidence from those with high balance confidence. Participants, all female and living in the community, completed the Activities-specific Balance Confidence (ABC) scale and then performed a series of 16 stance and gait tasks. Duration and trunk pitch and roll sway were calculated for all tasks. Low (ABC = 70%, n = 24, mean age = 66.5 years) and high (ABC score = 90%, n = 50, mean age = 67.2 years) balance confidence groups were identified from the pool of participants. ANOVA procedures showed a number of significant group differences across measures and tasks. Stepwise linear discriminant analysis was then performed using the most significant results from the ANOVAs. Classification accuracy of 82.6% and 96.0% for low and high balance confidence groups respectively was achieved with 6 tests and their associated measures. The tests were stance eyes open roll angle, stance eyes open on foam pitch angle, walk rotating head duration, walk pitching head duration, tandem walk eyes open on foam duration and roll angle, and modified get-up-and-go roll velocity. Low balance confidence was associated larger stance trunk sway, longer gait durations, and reduced gait trunk sway. This research is significant as it can improve the efficacy of balance assessment protocols and provide information to assist in the development of intervention programs to improve balance in individuals with low balance confidence.

Controlling feedback to test attentional focus effects: A replication and extension of Shea and Wulf (1999)

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Focus of attention has repeatedly been shown to moderate performance and learning. Despite the evidence, there is only one study where focus has been isolated independently

from physical change in attention and when the task goal was not removed from the action. Shea and Wulf (1999) manipulated feedback and focus during a balance task. Although feedback looked the same, participants believed it represented the platform (EXT) or feet (INT). Advantages were noted for EXT groups, even with feedback. We conducted a replication with 3 additional conditions: a no-focus control group, concurrent probes to assess instructional adherence, no vision and switched instruction transfer tests. Five groups were tested; 2 Feedback × 2 Focus and a feedback-only Control group. Across practice there were no group differences, but Focus and Feedback interacted independently with trial and day (ps < .05). Feedback was better than no feedback in later trials and EXT was better than INT early and later in practice. Unlike Shea and Wulf (1999), Focus and Feedback did not interact. Controls had the lowest error, although there was only a trend for them to be more accurate across trials ($p = .08$). In retention there were no group effects. Only on the last retention trial was EXT more accurate than INT ($p < .05$), although never better than Controls. If removing vision causes participants to focus on their body, EXT groups should be most affected. Although error increased without vision, only a feedback effect was seen ($p < .05$). No feedback groups showed most error. There was only a trend for Control and INT feedback groups to decrease error with EXT instructions, but the EXT group did not change ($p = .10$). Attentional focus moderates performance in practice, irrespective of feedback. EXT was generally better than INT, but never better than no- instructions. It seems that for this task, focus affects performance only when its use is prompted. Augmented feedback does not necessitate an EXT focus and when feedback is available, EXT focus instructions do not aid learning.

Practice with anxiety improves performance, but only when anxious: Evidence for the specificity of practice hypothesis

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We investigated for the first time whether the principles of specificity could be extended to the psychological construct of anxiety and whether any benefits of practicing with anxiety are dependent on the amount of exposure and timing of that exposure in relation to where in learning the exposure occurs. In Experiment 1, novices practiced a discrete golf-putting task in one of four groups: all practice trials under anxiety (anxiety), non-anxiety (control), or a combination of these two (i.e., the first half of practice under anxiety before changing to non-anxiety conditions, anxiety-control, or the reverse of this, control-anxiety). Following acquisition, all groups were transferred to an anxiety condition. Results revealed a significant acquisition-to-transfer decrement in performance between acquisition and transfer for the control group only. In Experiment 2, novices practiced a complex rock climbing task in one of the four groups detailed above, before being transferred to a high anxiety conditions and then to a low anxiety condition. Performance was greater in anxiety transfer following practice with anxiety. However, these benefits were influenced by the timing of anxiety exposure since performance was greatest when exposure to anxiety occurred in the latter half of acquisition. In the subsequent low anxiety transfer test, performance was lowest for those who had practiced with anxiety only, thus providing support for the specificity of practice hypothesis. Results demonstrate that the specificity of learning principle can be extended to include the psychological construct of anxiety. Furthermore, the specificity advantage appears dependent on its timing in the learning process.

Visual perception and action coupling on golf putting: Why not looking at the hole

Lee, Se Hoon; Kim, Sangbum; Chung-Ang University

Direct perception action theory argues that perception and action processes are functionally intertwined. The closer coupling visual perception and action on task goals may introduce better performances. We hypothesized that looking at the hole while golf putting facilitate direct perception action coupling and enhance golf putting performance. The current study investigated the golf performance on expertise level (expert vs. novice) and fixation location (hole, ball). Ten experts and 10 novices participated in this study, testing at three different distances (1 m, 4 m, 8 m) with each participant completing total of 60 trials under 6 different conditions (10 trials per each condition). The dependent measures were radial error, variable error, and normalized jerk cost for golf putting performance. The experimental design was $2 \times 2 \times 3$ ANOVA with repeated measures on second and third factors. The results of this study were followings. First, experts showed higher accuracy and consistency than novices. Secondly, experts achieved higher accuracy and consistency than novices when looking the ball, whereas novices tended to show higher accuracy and consistency with their eyes on the hole. Finally, in case of 4m distance condition with looking at the hole, both group showed more efficient and smoother back swing and forward swing of golf putting.

Bilateral arm training with high frequency rTMS: Evidence for motor function recovery and cortical reorganization after stroke

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The studies of repetitive transcranial magnetic stimulation and bilateral training produced convincing evidence of motor improvements in subjects with hemiparesis. The purpose of this research was to determine the effect of high frequency rTMS in conjunction with bilateral arm training on motor improvements of the upper extremity in subjects who had experienced CVA and had chronic hemiparesis. Volunteer participants (7 women and 13 men) had a CVA at least 1 year ago. The mean length of time since CVA onset was 19.1 months, and the mean age of the sample was 53.7 year. Participants were randomly assigned with the restriction that 20 subjects were tested in the two training groups (10 each in the unilateral and bilateral groups with rTMS). One baseline TMS mapping sessions were completed one week prior to initiation of the training protocols. Motor impairment assessment using the JTT, box & block, and Purdue pegboard test also undertaken on the day prior to training commencement. For the bilateral training group, rTMS was delivered to the scalp over the motor cortex of the affected hemisphere. rTMS involved a train of 50 pulses at 10 Hz and 90% RMT. Motor training was carried out immediately after the end of each stimulation. The chest guard was used to prevent the patient from using the trunk while reaching forward. After 12 weeks of bilateral training plus rTMS a stroke patient showed improvement in upper-extremity function compared to unilateral group. In motor cortical excitability within affected hemisphere, an increased in map volume and recruitment curves following bilateral training.

Context-dependent learning in people with Parkinson's disease

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Background: It is often observed that people demonstrate superior performance in the context in which they originally learned a motor task and do not perform as well if the task is carried

out in a novel context. This behavior is called context-dependent learning (CDL). Clinical observations suggest that people with Parkinson's disease (PD) have difficulty generalizing learned motor skills to different contexts. However, it is not known whether this observation represents CDL. Therefore, the purpose of this study was to investigate whether people with PD demonstrated greater CDL compared to healthy subjects. Methods: Nine people with idiopathic PD and 8 age-matched healthy controls participated in this study. The participants were required to practice three finger sequences embedded in specific display contexts (colors and locations). Retention tests, 1-day post practice, were given under SAME and SWITCH conditions. In the SAME condition, the sequence-context (S-C) associations remained the same as practice, while the S-C associations were changed for the SWITCH test. The primary outcome was total time accuracy cost (TTAC), calculated as the time for a subject to complete the sequence task divided by the proportion of accurate trials. The TTAC was decomposed into reaction time accuracy cost (RTAC) and movement time accuracy cost (MTAC). Switch cost was calculated as (SWITCH - SAME) / SAME test × 100%; with a larger switch cost indicative of greater CDL. Due to small sample size, effect size (ES), in addition to *p* value, was calculated to estimate the magnitude of between group differences. Results: All participants improved over practice ($p < 0.01$) with no significant group differences at the end of practice. At retention, the switch cost for the PD group was higher than that of the control group for all three measures (TTAC: PD = 56.7, control = 22.7, $p = 0.06$, ES = 1.0; RTAC: PD = 45.3, control = 25.3, $p = 0.22$, ES = 0.7; MTAC: PD = 45.3, control = 25.3, $p = 0.02$, ES = 1.4). Conclusion: The results suggest that people with PD demonstrate greater CDL than healthy adults.

The roles of self-identity and expertise in judging spatial properties of a remote target in aimed throwing

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Previous study showed that expert throwers can effectively utilize the kinematic information in point-light displays (PLDs) of their own throws to gauge both the distance and height of a remote target, even without viewing the ball trajectory (Zhu & Ravi, 2010). However, it remained unknown whether this superior perceptual ability would vary depending on the identity of the thrower in PLDs or the throwing expertise of the judger. The current study was aimed to answer this question. Twelve participants were recruited from the University of Wyoming campus, split equally among expert and novice throwers. They were presented videos of experts throwing at a remote target that were used in previous study. Using a computerized program, participant's judgment on the distance and height of a remote target for a particular throw was recorded. A total of 45 PLDs were presented to each participant. A mixed design ANOVA revealed percentages of accurate judgment for both experts and novices were above chance level for distance, height, and combined target location; however, experts were more accurate than novices ($F_{1,10} = 12.11$, $p < 0.05$). In addition, the logistic regression on the occurrences of judging both distance and height for a given target indicated that the more skilled the judgers were at throwing, the more higher their odds of guessing correctly (odds ratio = 6.69, $p < 0.001$). In addition, we found that a 10-fold increase in reaction time decreased the odds of judging the target placement correctly (odds ratio = 0.52, $p < 0.05$). Our findings suggested that the kinematic information in PLDs is sufficient for people with or without throwing experience to utilize for judging the spatial properties of a remote target, where the identity of the thrower in PLDs does not matter. However, having more experience of throwing will increase the judger's sensitivity to the kinematic information for judgment. Thus, the kinematic specification of dynamics

(KSD) theory (Runeson et al, 1981) is more accountable than the common coding theory (Prinz, 1997) in understanding the perception of biological motion.

Choose to move: The motivational impact of autonomy support on motor learning

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Numerous studies in the motor learning domain have demonstrated learning advantages of self-controlled practice relative to (yoked) control conditions. In separate lines of evidence in the social-psychological literature, findings show that giving participants incidental choices and providing autonomy support can result in superior outcomes compared with not providing choices or thwarting autonomy. We hypothesized that motor learning could be enhanced by giving learners choices—even if those choices are unrelated to task performance. In Experiment 1, two groups of participants practiced a golf putting task. While one group (choice group) was able to select the color of golf balls (white, yellow, or orange) before each block of 10 trials, yoked control participants were provided with the same colored golf balls as their choice-group counterparts. The results of a delayed retention test indicated significantly greater putting accuracy for the choice compared with the yoked group. The choice group also reported higher levels of interest/enjoyment. Experiment 2 went one step further by asking choice group participants two questions that were completely unrelated to the practice task (balancing on a stabilometer): (a) which of two tasks they wanted to perform afterward (coincident timing or hand dynamometry) and (b) which of two prints of paintings by Renoir they thought the investigator should hang on the laboratory wall. Yoked group participants were simply informed about which task they would perform afterwards and of the painting the experimenter would put on the wall. Balance learning was significantly more effective in the choice group on a retention test. Thus, self-controlled practice conditions can operate without providing task-relevant information, content, or strategic learning advantages. Self-controlled effects in motor learning may be motivational in nature, attributable to satisfaction of fundamental autonomy needs.

Test–retest reliability of foot speed and reaction time related to concussion assessment

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The prevalence and incidence of concussion from a sport-related activity in the United States have multiplied in the last few years. Diagnostic and management decisions are based on many factors, including patient symptoms, physical examinations, and specialized tests designed to detect deficits due to concussive injuries. Recently new computerized tests have been developed to evaluate the post-concussion status, such as the Immediate Post-concussion Assessment and Cognitive Testing battery (ImPACT), which is widely used at different sport settings. However, the test-retest reliabilities of ImPACT were inconsistent in the reports. Moreover, the tests are limited to one segment of brain performances. A multifaceted approach for concussion assessment program including both cognitive and physical functions (e.g., balance performance) was recommended in the field. The purpose of the present study was designed to examine the test-retest reliability of reaction time and dynamic balance performance of the Quick Feet Board tests when the typical test-retest interval observed in sport concussion assessment and return –to-play management was used. Ten active young adults (mean age = 23.6 years; STD = 2.5) with 7 males and 3 females were tested on Reaction Time (RT) drill and Foot Speed (FS) drill on the Quick Feet Board at the baseline, 7 days and 42 days later. The results revealed a significantly high intra-class

reliability coefficient for both RT and FS drill performances, Cronbach's $\alpha = 0.884$, and 0.975 respectively. The data suggest that the FS and RT tests on this portable, inexpensive equipment (i.e., the Quick Feet Board), appear to be a reliable tool in assessing balance deficits the current concussion assessment programs may need.

Do offline performance improvements emerge in both implicit and explicit learning environments?

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There has been interest in recent years in the notion that procedural learning continues for a considerable time following the completion of a bout of practice. Offline improvement, as it has been called, is particularly dependent on sleep and, according to some, most notable when learning occurs at an explicit level. In the present work we directly tested the emergence of offline performance improvement during explicit and implicit learning using a serial reaction time (SRT) task protocol previously designed to encourage learning via implicit and explicit procedures. Specifically, the same 12-item SRT task was practiced using either a 0 or 250 ms response-to-stimulus interval (RSI). In previous work a short RSI revealed little explicit knowledge despite sequence performance improvements whereas performance improvements for the SRT task acquired with the longer RSI was associated with relatively rich explicit knowledge (e.g., Destrebecqz & Cleeremans, 2001). In the present work individuals performed the 12-element sequence with either a 0 and 250 RSI during practice which was followed by test trials either immediately (as in previous work) or after 24-hr delay to assess the presence of offline improvement. If learning via explicit means is more privy to offline benefits, individuals exposed to a 250 ms RSI condition would be expected to exhibit the most significant offline improvements for the delayed test. Data from the immediate test were consistent with previous work revealing sequence learning in both the 0 and 250 ms conditions. The extent of sequence learning, as indexed by the test learning score (random trial performance - sequence trial), was not increased across a 24-hr interval for either RSI conditions suggesting an absence of offline improvement. However, in the 250 RSI condition (i.e., explicit) the sequence learning score was low due to a surprisingly large reduction in random sequence test performance. These data will be discussed in terms of consolidating sequence-specific and more general sequence learning components.

Adapting postural responses on the basis of constraints imposed by a voluntary task in Parkinson's disease patients

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This study aimed at comparing the effect of stability constraint imposed by a voluntary task on reactive postural responses between Parkinson's disease (PD) and healthy elderly subjects. Experimental task consisted of keeping upright stance while holding a cylinder on a tray. The cylinder was to be maintained stably either in the situation of flat (low constraint) or round (high constraint) side turned down during unpredictable backward motion of the

support base. Participants performed blocks of trials alternating low and high constraint, manipulating the initial constraint condition. Results showed that PD participants accomplished the voluntary task as well as controls, showing smaller tray velocity in the high as compared with the low constraint condition. Analysis of postural responses indicated increased latency of muscular activation under high constraint more markedly in controls than in PD. Controls presented different patterns of hip- shoulder coordination as a function of task constraint while PD had a relatively invariable pattern. Initiating by high task constraint led to (a) decreased postural stability in PD only, and (b) reduced peak hip flexion in the following trials in controls, while PD was unaffected in hip motion. These results suggest that Parkinson's disease lead to a limited capacity to adapt postural responses on the basis of constraints imposed by a voluntary task.

On the advantage of an external focus of attention: A benefit to learning or performance?

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Although there is general agreement in the sport science community that the focus of attention (FOA) has significant effects on performance, there is some debate about whether or not the FOA adopted during training affects learning. A large number of studies on the focus of attention have shown that subjects who train with an external FOA perform better on subsequent retention and transfer tests. However, the FOA was not experimentally controlled during testing. Thus, the current study used a dart-throwing paradigm in which the FOA was experimentally manipulated at both training and testing on short and long timescale (Experiments 1 & 2, respectively). The FOA that subjects used during training had minimal effect on performance at test, whereas the FOA used during test had a significant effect on subjects' performance. These results suggest that an external FOA confers an advantage primarily to performance, but not learning (contrary to the findings of Totsika & Wulf, 2003). Furthermore this study suggests that sufficient learning must take place for an external focus to be advantageous; that is, an external FOA exploits learned motor representations for optimal performance, rather than optimizing the learning process per se.

Simulation of actions: Effector vs. action specific maps within the human motor system?

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Understanding the representation of actions during action simulation is an intensely debated issue in the field of cognitive neuroscience. Although there is a wide consensus that the underlying brain mechanism of the simulation of body movements are motor representations lying within the core and broader motor system, the organization of the respective motor maps within this areas remains controversial. On this background, the present study examined whether action simulation states, that is, motor imagery and action observation, run rather on action-specific motor or on effector-specific motor-maps within the motor cortex. During fMRI-scanning 18 right-handed and right-footed volunteers (9 female, mean age = 26 years, $SD = 2.7$) ran through twelve experimental conditions and one baseline condition. In the twelve experimental conditions, participants had to observe or imagine right-hand movements or right-foot movements with different action goals. The fMRI results showed an action-specific organization within the premotor area of both hemispheres during motor imagery and action observation. However, there were lesser pronounced effector-specific activation sites during both simulation processes within the premotor area. Therefore, it is

concluded that multiple motor maps rather than a single, continuous map of the body might be located in the premotor area.

The role of reinvestment in performance of simulated laparoscopic surgery under time pressure

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Objective To examine the impact of 'reinvestment' on laparoscopic performance under a common intra-operative stressor, time pressure. Background Study of the breakdown of performance under stress has been gaining momentum in the motor skill learning domain as well as domains like aviation and anesthesia, but this has not been the case in the domain of surgery until recently. Research on intra-operative stressors has focused on external factors without considering individual differences in the ability to cope with stress. One individual difference that is implicated in adverse effects of stress on performance is 'reinvestment', the propensity for conscious monitoring and control of movements. Methods Thirty-one medical students were divided into high and low reinvestment groups based on their scores on the Movement Specific Reinvestment Scale. Participants were first trained to proficiency on a peg transfer task and then tested on the same task in a control and time pressure condition. In the control condition, participants were simply asked to do their best, as they had in training. In the time pressure condition, participants were informed that operating surgeons sometimes are required to perform under time constraints and they should try to complete the task faster than their best time in training (of which they were informed).Outcome measures included generic performance and process measures. Stress levels were assessed using heart rate and the State Trait Anxiety Inventory (STAI). Results High and low reinvesters demonstrated increased anxiety levels from control to time pressure conditions as indicated by their STAI scores, although no differences in heart rate were found. Low reinvesters performed significantly faster when under time pressure, whereas high reinvesters showed no change in performance times. Low reinvesters tended to display greater performance efficiency (shorter path lengths, fewer hand movements) than high reinvesters. Conclusion Trained medical students with a high individual propensity to consciously monitor and control their movements (high reinvesters) displayed less capability (than low reinvesters) to meet the demands imposed by time pressure during a laparoscopic task. The finding implies that the propensity for reinvestment may have a moderating effect on laparoscopic performance under time pressure.

Effect of practice time in decision-making in volleyball defense

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The goal of this study was to analyze the effect of practice time in decision making in a defense task in volleyball players. Forty-eight young adults (all males) were assigned into three groups based upon their accumulated experience playing systematic volleyball: the experienced group (EG) had 16 individuals (27.3±6.8 years old) with about 13.1±5.7 years of experience playing volleyball; the intermediate group (IG) had 16 individuals (17±0.4 years old) with 2.2±1.0 years of experience in volleyball; finally, the third novice group (NG) had 16 individuals (22.2±1.5 years old) with no systematic volleyball experience – only deliberated practice. All participants were asked to watch videos of professional players

executing an attack finalization and predict the place in which the ball would land in each of these finalizations. Thirty-two attack finalizations were randomly presented in five different conditions: (OT1) 399 ms; (OT2) 266 ms; (OT3) 133 ms before ball-contact; (OT4) at the exact ball-contact time and; (OT5) 133 ms after ball contact. The results of the Kruskal-Wallis test showed main group effect for the following conditions OT2 ($p < 0.001$), OT3 ($p = 0.02$), and OT4 ($p = 0.04$). The Mann-Whitney test showed that EG and IG were different in OT2 ($p = 0.03$) and OT3 ($p = 0.01$), EG and NG in OT2 ($p < 0.001$), OT3 ($p = 0.02$) and OT4 ($p = 0.02$), and IG and NG were not different. In addition, we found that up to 399 ms before ball-contact, none of the individuals were able to use visual cues to predict the place in which the ball would land. From the results, we concluded that systematic experience (EG) allows for better predictions at 399 ms and 133 ms before the ball contact. The IG group could make proper predictions at 133 ms before the ball contact, and participants with no systematized practical experience in volleyball need the information of attacker contact with the ball to reach a higher number of correct predictions.

When unintended movements "leak" out: A startling acoustic stimulus can elicit a prepared response during motor imagery and action observation

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Covert forms of practice, such as observation and imagery, have been shown to provide learning benefits and thus provide an alternate option to physical practice. One explanation for these learning benefits is the functional equivalence or Simulation Theory (Jeannerod, 2001), in which covert practice activates similar neural pathways as physical practice. In this study we used a startling acoustic stimulus (SAS) to probe motor pathways to determine whether imagery and observation result in movement preparation similar to that seen in overt movements. A SAS has been shown to trigger prepared movements involuntarily at short latencies via a subcortical pathway. Startle trials were interspersed with control trials while participants ($n = 16$) performed or imagined a right hand key lift movement or observed a model perform the key lift. During startle trials, 100% of intended movements were elicited at a short latency ($M = 76$ ms) in comparison to control reaction time trials ($M = 110$ ms). For imagined movements, although we rarely observed full key lift movements, unimanual partial movements (assessed by force changes and muscle activation) were elicited by the SAS in the imagined hand on approximately 30% of the trials. These partial responses were also seen for startle trials in the observed hand on approximately 20% of the trials. These results indicate that imagery and observation can promote motor preparation in a similar manner to intended movements. Covert and overt movements may involve similar pathways with either reduced activation levels or an inhibitory process acting to inhibit overt movements in the former. Because the SAS increases neural activation and causes involuntary initiation, it may cause some activation to "leak" out to the muscles, resulting in partial responses. Although not all individuals showed these effects and the majority of trials did not produce a movement, this may relate to the level of activation achieved rather than point to a qualitatively different neural process. This research was supported by NSERC.

Posture and movement planning improves after arm training in stranding in patients hemiparesis post stroke

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Objective: Stroke leads to chronic disability of daily living skills in the elderly. These skills require postural control, reaching and grasping of objects in the standing position. Reaching to grasp an object involves anticipatory postural adjustments (APAs) of the legs that precede and accompany the goal directed arm movement, and reactive responses that stabilize balance and prevent falling. In previous work we identified delayed and reduced magnitude of APAs preceding reaching in standing using a startling acoustic stimulus. We hypothesize that training the arm in standing will engage pathways that contribute to APAs. We report the effects on posture and movement planning after 6 weeks of arm training in standing. Subjects: Nine participants with chronic hemiparesis and five age-matched control subjects. Methods: Testing included use of a startling acoustic stimulus prior to an instructed delay task of reaching in standing. The startle stimulus was randomly applied at 1500, -1000, 500, -200, 0, or +100 ms relative to a go cue. APA and arm responses were characterized by onset and maximal displacement of the center of pressure, paretic hand movement, and onset/offset of EMG from postural and arm muscles. Training for subjects with stroke consisted of 6 weeks of task-oriented training with the paretic arm in standing with no explicit cues for postural weight shift. Results: After training, subjects with stroke demonstrated an increased occurrence of startle-induced responses. During volitional execution of the reaching task, APAs in stroke, while delayed and diminished compared to controls, were significantly improved. EMG timing improved post training to resemble timing characteristics of controls. The onset and timing of reaching improved significantly post training. Discussion: Results indicate gains in movement planning and preparation of anticipatory postural responses and goal directed arm movement in stroke. Conclusion: Arm training in the functional context of standing can lead to gains in both postural control and goal directed function of the arm.

The self: Your own worst enemy? A test of the self-invoking trigger hypothesis

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The self-invoking trigger hypothesis was recently proposed by Wulf and Lewthwaite (2010) as the mechanism underlying the robust effects of attentional focus on motor learning and performance. The hypothesis suggests that causing individuals to access their self-schema will negatively impact their ability to learn and perform a motor skill. The purpose of the present study was to provide an initial test of this hypothesis by causing one group of participants to activate their self-schema in a straightforward manner. Participants ($N = 36$) were assigned to either a self- activated or control condition and asked to practice a wiffleball hitting task 50 times on two separate days. Participants in the self-activated group were asked to write about their personal experiences, emotions, beliefs, and qualities regarding baseball or softball. Participants in the control condition wrote for the same amount of time, but ranked the items around them in terms of size, shape, color, and alphabetical order. Participants returned on a third day to perform a retention and transfer test without the manipulation. Results indicated that the self-activated group learned the hitting task less effectively than controls, as indicated by significantly less effective performance on both the retention and transfer test. Efforts to assess the degree of self-activation experienced by each group via questionnaire and signature size analysis yielded non-significant or equivocal results. The findings reported here provide some initial support for the self-invoking trigger hypothesis, though more future research is needed to clarify the link between cognitive self-activation and motor skill learning.

The effects of task and ego orientations on motor learning

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Perceived competence and its effects on motivation are thought to vary as a function of a person's interpretation. Achievement goal theory assumes that differences in goal orientations (task/ego) are the critical antecedents to variations in the direction and intensity of behavior. Task-oriented individuals (TOI) believe that capabilities can change and focus on learning, skill, self-reference, mastery, personal improvement, and effort. Ego-oriented individuals (EOI) believe that capabilities are fixed and focus on performance, outcome, other-reference, and personal success. The purpose of this study was to examine the effects of task and ego orientations on the acquisition, retention, and transfer of a balance task. After completing a questionnaire that assessed scores in task and ego orientation (Roberts et al., 1998), 56 participants performed 18 acquisition trials with knowledge of results (KR). The task required participants to assume a parallel stance on a stabilometer, move it toward horizontal, and keep it as level as possible during each 40 s trial. After acquisition, participants completed a questionnaire to assess motivation variables of pressure/tension, perceived competence, perceived choice, and interest/enjoyment (Ryan, 1982; McCauley et al., 1989). Retention and transfer (staggered stance) were administered 24 hr later and consisted of 3 no-KR trials each. High and low scores in goal orientations were defined by means of a median-split procedure (Duda & Ntoumanis, 2003). Analyses showed that the high-EOI group had lower RMSE on transfer than the low-EOI group ($p = 0.024$) and that ego orientation and perceived competence were predictors of RMSE on transfer [RMSE = 15.53 – (0.82 × Ego Orientation) – (0.75 × Perceived Competence)]. The findings suggest that high EOI might be predisposed to use adaptive strategies to facilitate performance when feedback is withdrawn. For example, high EOI might be more immune to the guidance function of augmented feedback because they do not believe that such information can be used to change their proficiency at the task.

Interpersonal coupling in rowing: The mediating role of the environment

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Evidence currently supports the view that intentional interpersonal coordination (IIC) is a self-organizing phenomenon facilitated by visual perception of co-actors in a coordinative coupling (Schmidt, Richardson, Arsenault, & Galantucci, 2007). The present study examines how apparent IIC is achieved in situations where visual information is limited for co-actors in a rowing boat. In paired rowing boats only one of the actors, [bow seat] gets to see the actions of the other [stroke seat]. Thus IIC appears to be facilitated despite the lack of important visual information for the control of the dyad. Adopting a mimetic approach to expert coordination, the present study qualitatively examined the experiences of expert performers ($N = 9$) and coaches ($N = 4$) with respect to how IIC was achieved in paired rowing boats. Themes were explored using inductive content analysis, which led to layered model of control. Rowers and coaches reported the use of multiple perceptual sources in order to achieve IIC. As expected (Kelso, 1995; Schmidt & O'Brien, 1997; Turvey, 1990), rowers in the bow of a pair boat make use of visual information provided by the partner in front of them [stroke]. However, this perceptual information is subordinate to perception

of the relationship between the boat hull and water passing beside it. Stroke seat, in the absence of visual information about his/her partner, achieves coordination by picking up information about the lifting or looming of the boat's stern along with water passage past the hull. In this case it appears that apparent or desired IIC is supported by the perception of extra-personal variables, in this case boat behavior; as this perceptual information source is used by both actors. To conclude, co-actors in two person rowing boats use multiple sources of perceptual information for apparent IIC that changes according to task constraints. Where visual information is restricted IIC is facilitated via extra-personal perceptual information and apparent IIC switches to intentional extra-personal coordination.

The influence of target size on the integration of sequential movements for single and dual limb actions

Mottram, Tom M., Bangor University; Khan, Michael A., University of Windsor; Lawrence, Gavin P., Bangor University

Movement times to a single target are typically shorter compared to when movement to a second target is required (i.e., one target advantage). The one-target advantage has been shown to emerge regardless of participants' hand preference, the amount of practice, and the availability of visual feedback. Recently, it has also been shown to be present when participants switch hands at the first target. In the present study, our goal was to investigate the influence of target size on the one-target advantage in both single limb and two limb sequential aiming. Participants performed movements to a single target, movements to two targets using a single limb and movements to two targets where the limb was switched at the first target. Participants performed these movements under four target size conditions: Large-Large, Large-Small, Small-Large, and Small-Small. The one target advantage was present for both single and two limb conditions when the first target was large (Large-Large, Large-Small) but not when the first target was small (Small-Large, Small-Small). Analysis of ellipse areas of endpoint variability at the first target revealed that participants constrained their movements in both the single and two limb tasks when the size of the second target was small. These findings suggest that the transition between limbs in two hand sequential aiming movements obeys similar control principles as movements performed with a single limb.

The influence of prepared response features on decision-making processes using a free choice paradigm

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The influence of precue presentation on various facets of response selection has received significant research interest. Reaction time and movement time have been the focus of a number of studies, and are used as indicators of response selection processes. A novel free choice paradigm has been developed to better examine the influence of prepared actions on response selection. In the current experiment an extension of our free choice paradigm was carried out to further establish the influence of congruent features of a precue in a reaction time task. Participants were required to make button-press responses using index and middle finger flexion and extension movements. Precue and stimulus presentation patterns meant participants were placed into both free and forced choice conditions. In forced choice conditions, participants were required to produce a response matching that of the precue. In free choice conditions participants selected from two responses containing

features that matched elements of the precue but using the opposing limb. For example, precue presentation could indicate a left index finger (effector) flexion (action) response, followed by a stimulus requiring either a right middle finger flexion or extension response. Of primary interest were the response selection patterns of participants when placed under free choice conditions. Data revealed significantly faster reaction times under forced choice conditions, indicating subjects were planning the prepared response on all trials. Under free choice conditions response options that contained effector features matching the precue were selected more often than responses containing action features. As indicated by previous examinations of the free choice paradigm, whilst a combination of congruent motoric features of an unprepared response produced highest selection rates, the influence of prepared effector features appear stronger than those of a prepared action.

Training of anticipatory skill in a striking sport using point-light displays

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Point-light studies have shown that the minimal visual information required to anticipate an opponent's action is kinematics. Little is known of whether point-light displays can be used to improve anticipatory skill and whether benefits can be found on video simulation and in-situ tests. The purpose of this experiment was twofold: (i) to examine the efficacy of point-light display training to video simulation and in-situ anticipation tests and (ii) to compare point-light display training to sports-specific practice (control). Cricket batting was used as an exemplar striking sport skill. Cricket batsmen from two different cricket clubs were recruited and assigned in a quasi-random fashion to a point-light display training group ($n = 6$) and a control group ($n = 6$). A pre- and post-test control group design was used where participants were assessed using previously validated video simulation and in-situ cricket batting tests. Point-light displays of a cricket bowler delivering three different ball types were developed with temporal exaggeration applied between key kinematic events previously reported in the literature to provide anticipatory information. Displays were presented under three levels of temporal occlusion including occlusion at the point of ball release and prior to ball bounce, with a no occlusion control condition. Participants were required to indicate their prediction of ball type in an answer booklet, with feedback provided for occluded trials. The point-light training group received 6 weeks of anticipatory training including one session per week of 36 trials. In the video simulation test, results revealed improvement for prediction of ball type for the point-light training group, but not the control group. In the in-situ test, again, results revealed improvement only for the point-light training group for body positioning (foot movements), but not for bat-ball interception. The findings can be explained through the common-coding and neural visual pathways theoretical frameworks. Practical application of the findings will also be discussed.

Training perceptual anticipation in the absence of vision: A case of motor-visual transfer

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Over the past decade, significant evidence has accumulated supporting the common-coding hypothesis that a shared pathway exists in the human brain for processing vision and action (e.g., Hommel et al 2001). Neurophysiologic research has revealed overlap in the neural areas activated during acting, seeing and imagining (e.g., Decety et al, 1994). Perception can inform action through observation. Less studied is the influence that action exerts on perception. In recent studies involving perceptual-motor experts, attempts have been made

to isolate the effects of motor experience on perceptual anticipation (that is, future predictions). Aglioti et al (2008) compared the ability of expert and novice basketball players and visual experts (e.g., sports writers) to predict whether a shot shown on a video would land in the basket. The expert basketball players outperformed the other two groups, leading to the conclusion that it was the expert players' superior motor skill which translated into the perceptual superiority. However, there is some question as to how well these expertise studies control for the overall effects of visual and motor experience. We conducted a learning study allowing isolation of visual experience. Over two days we trained participants (n = 7) to hit target areas on a dartboard while blindfolded (with KR). Before and after 'motor' training participants were shown video clips of darts being thrown at a dartboard. The video clips were temporally occluded at various points. Participants were asked to anticipate the landing position of the dart. The no-vision group significantly improved their perceptual anticipation performance from pre- to post-test ($p < .05$). A control group (n = 7), who performed the pre-and post-video test, but received no motor training, did not improve. We interpret these findings as strong evidence for a common representational medium for action and perception, and we suggest that action experiences lead to the generation of visual consequences even in the absence of vision. Funding provided by NSERC Canada to the last author.

Quiet eye duration and visual motor control during a full swing: A comparison of expert and novice golfers

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Previous research has well demonstrated that quiet eye duration will influence putting in golf as well as influence the timing and kinematic characteristics of self-paced motor tasks. It is also well established that pre-performance motor planning will impact the impending motor action. However, there has been little research examining visual motor control during a full golf swing on a regulation golf course as well as the visual motor planning of skilled golfers. The purpose of this study was to examine visual motor control of expert and novice golfers (n = 20) during a full swing in a natural environment. We examined visual fixations using an Applied Science Laboratories Mobile Eye XG proceeding, during, and following a full golf swing during the play on a Par 5 hole of standard golf course. Visual fixations on target location, quiet eye duration, ball location, distance from target, score, and perceived ratings of success were the dependent measures. Overall results demonstrated differences in target location and quiet eye duration between experts and novices as well as differences for these dependent measures and perceived success. The results are discussed in light of the quiet eye and visual motor control.

Visual behaviors of soccer players during the instep and inside-foot kicks

Nagano, Tomohisa; Kato, Takaaki; Keio University

In this study, we compared the visual behaviors of soccer players between near and far aiming tasks. University footballers (n = 10) volunteered to take part in this study. Participants were fitted with an eye-mark recorder EMR-9 (NAC Image Technology, Inc., Tokyo, Japan) to record the gaze while kicking. In the game, different kicks are used depending on the distance from a kicker to the target. Therefore in a near aiming task, they were required to step forward and kick a ball with the inside of the foot. Meanwhile in a far aiming task, they kicked a ball with the instep of the foot. The top three scorers of each task were defined as the High-score group, and the three low scorers were defined as

the Low-score group. Quiet eye was defined as the final fixation on the target prior to the initiation of movement. Visual pivot was defined as a fixation spot during the execution of movement. In Task 1, high-scorers exhibited longer fixations on the target (quiet eye) during the preparation phase of the action than low-scorers did. High-scorers also set their visual pivot on the frontal space between the target and the ball during kicking phase. In Task 2, high-scorers exhibited longer quiet eye duration than low-scorers did. High-scorers also exhibited longer fixations on the ball during kicking phase than low-scorers did. These results indicate that visual behaviors of high-scorers in each task are important for soccer players to kick a ball successfully.

Expert batters' anticipation of the future location of fast-moving objects

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To perform well in sports requiring fast visual perception (e.g., baseball), players must compensate for the delays in the neural processing of perceptual information in the human visual system. The memory of the final position of a moving object is distorted forward along its path of motion, an effect called representational momentum (Freyd 1983). This top-down modulation of visual perception could compensate for the neural delay in following a moving object, anticipating its forthcoming position, and interacting with it appropriately. We examined whether experienced batters internally modulate the location of a fast-moving object and if this modulation is related to athletic performance. In our study, 9 expert and 9 novice baseball players performed a coincident anticipation task, in which a target moved from one end of a straight 400-cm trackway at a constant velocity (10 or 15 m/s). A trial cue was presented for 3 seconds, and in half of the trials, it was suddenly occluded 200 cm before its arrival on the target. In both the non-occlusion and occlusion conditions, the participants had to press a button concurrently with the arrival on a target and verbally report their subjective assessment of the occluded position. The data for these participants were analyzed with a 2 × 2 × 2 (Group × Occlusion × Velocity) factorial ANOVA, with repeated measures on the last two factors. A significant interaction emerged between Group and Occlusion, $F(1, 16) = 19.70$, $p < .001$, $\eta_p^2 = .55$. Experts reported a longer subjective occlusion point (103.5 cm from the actual occluded position) than did novices (35.7 cm) in the occlusion condition. A highly significant negative correlation emerged between the subjective occluded position and absolute coincident timing error ($r = -.82$, $p < .01$) in the 15-m/s occlusion condition. We thus infer that experts can internally modulate the location of fast-moving objects in an anticipated direction to circumvent the neural processing delay. This process might be used to control movement when interacting with such objects.

Extensive practice improves adaptation to unpredictable pertubration in a task of isometric force

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This study aimed to investigate the effects of different amounts of practice in adaptation to unpredictable perturbations. Twelve volunteers were divided into three experimental groups: Stabilization (SG), Super-Stabilization Group (SSG) and Control Group (CG). The

experiment was conducted in two phases: pre-exposure and exposure. During pre-exposure only SG and SSG practiced the task of elbow flexion in a load cell and they were different on the amount of practice before start the second phase: SG had to perform a block of three trials in a row in order to achieve 40% of maximum force in three seconds and GSS had to perform six blocks of three trials in a row in order to achieve a percentage of 40% of maximum force in three seconds. The exposure phase was conducted the next day with 126 trials; however, in 18 trials were inserted unpredictable perturbations characterized by a new goal: one with 60% of maximum force (PI) and another with 20% of maximum force (PII), each one with nine trials. The groups SG and SSG participated in this phase, plus a Control Group (CG). Dependent variables were performance measure (RMSE) and biceps and triceps electromyography (RMS). The results showed that in the pre-exposure, SSG and SG decreased the RMSE, and SSG had smaller RMSE than GS. The RMS was similar in both groups. During exposure phase, SSG had similar RMSE to SG smaller than CG. The three groups had similar RMS of biceps and triceps as well. In PII trials SSG had higher RMSE than CG, but was similar in PI. Moreover, SSG had smaller RMS of the biceps than SG in both PI and PII, as well as SG had smaller RMS of biceps than CG. There was no difference in triceps. When considering the RMSE between the groups in trials before and after PI and PII, no difference was found but the RMS of the biceps SSG was lower than SG and from CG was lower than SG. The results indicate that the group with a greater amount of practice has a lower RMS arm muscles in a maximum isometric task.

Identifying the mechanisms underpinning recognition of structured sequences of action

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The ability to recognize patterns of play has been identified as a characteristic of skilled performers in team sports (North, Ward, Ericsson, & Williams, 2011). We conducted three experiments to identify the specific information sources that skilled participants use to make recognition judgments when presented with dynamic, structured stimuli. A group of less skilled participants acted as controls. In all experiments, participants were presented with filmed stimuli containing structured action sequences. In a subsequent recognition phase, participants were presented with new and previously seen stimuli, and were required to make judgments as to whether or not each sequence had been presented earlier (or were edited versions of earlier sequences). In Experiment 1, skilled participants demonstrated superior sensitivity in recognition when viewing dynamic clips compared with static images as well as clips where the frames were presented in a non-sequential, random manner, implicating the importance of motion information when identifying familiar or unfamiliar sequences. In Experiment 2, we presented normal and mirror-reversed sequences in order to distort access to absolute motion information. Skilled participants demonstrated superior recognition sensitivity, but no significant differences were observed across viewing conditions, leading to the suggestion that skilled participants are more likely to extract relative rather than absolute motion when making such judgments. In Experiment 3, we manipulated relative motion information by occluding several display features for the duration of each film sequence. A significant decrement in performance was reported when centrally located features were occluded compared to those located in more peripheral positions. Findings indicate that skilled participants are particularly sensitive to relative motion information when attempting to recognize patterns in dynamic visual displays, involving interaction between numerous features.

Performance in a virtual video gaming task in old age

Nunes, Marcelo E. S.; Silva, Elisangela; Silva, Talita D.; Guimarães, Edna A.; Santos, Bruno S.; Santos, Lidia C.; Santos, Suely; Monteiro, Carlos B. M, Universidade de São Paulo

With aging, individuals show some change in posture and movement control which may cause decrease in motor performance. In order to keep older individuals active, virtual video gaming should also be considered. Nevertheless, the information about the elderly individuals' ability to learn a task in a virtual environment is limited. Thus, the objective of this study was to examine the learning process of a virtual video gaming task in old age. Fourteen individuals, 3 male and 11 female, between 60 and 74 years, performed a bowling task using the Nintendo Wii console. They performed 20 trials with the dominant hand during acquisition phase; 5 trials at the retention test; and 5 trials at the immediate transfer test with non-dominant hand. Performance was measured by the average of the bowling pins overturned in each trial. Maximum score was 10 pins in each trial. ANOVA showed no difference among acquisition blocks or between the last block of practice and retention and transfer tests. In conclusion, results did not show the practice effect of learning, perhaps due to the performance of participants was close to the maximum score starting from the first block of the experiment trials. It seems that the bowling task was easy to the elderly, even under the virtual environmental conditions of practice with the non-dominant hand.

Intermediate frequency of knowledge of performance provides performance gains for motor learning in the elderly

Nunes, Marcelo E. S.; Franzoni, Mariana M.; Monteiro, Carlos B. M.; Santos, Suely, Universidade de São Paulo

Motor learning researchers have been devoted to analyze which factors may affect the acquisition of motor skills, with particular emphasis on feedback and practice. It is known that the Knowledge of Performance (KP) has the function of guiding the learner's attention to critical aspects of the movement pattern. Considering that attention and memory can become a problem in old age, the objective of this study was to investigate the effect of frequency of KP in elderly individuals during the acquisition of the basketball free throw. Sixty active men and women aged 60-69 years of age, divided into three experimental groups received 100%, 66%, and 33% KP frequency during three practice sessions with 90 attempts. The task was the basketball free throw. Volunteers were asked to conduct tests of retention and transfer 24 hr after the last practice session. During the acquisition phase, the volunteers received KP on the movement pattern on the previous attempt; this information was obtained from a qualitative hierarchical checklist of the free throw (14 items). Sessions were recorded in order to confirm whether volunteers were able to score throughout sessions. ANOVA indicated that all individuals showed an improved performance in the retention and transfer tests. But the 66% KP group was superior in both qualitative (movement pattern) and quantitative (score) measurements throughout the trials ($p = 0.05$). In conclusion elderly people seem to need an optimal KP frequency supply during the learning process.

Conceding and colliding behaviors in an interpersonal motor task

Ogawa, Akane; Sekiya, Hiroshi; Hiroshima University

Failures of interpersonal coordination, such as concessions and collisions between teammates, have not been studied. The purpose of this study was to examine the characteristics

of concessions and collisions in acquisition and under pressure. Twenty right-handed female university students were randomly assigned to pairs and performed a serial-tapping task. A pair of participants faced each other standing on both sides of an apparatus with seven buttons in a row. They were instructed to push a flashing button as quickly and accurately as possible, with either member of the pair being able to push the button. When a flashing button was hit, the light went off, and another button flashed. The button flashed seven times in a trial. The participants performed 50 acquisition trials followed by 10 control test trials and 10 test trials under pressure. Pressure was induced by a small audience and instruction about penalty trials. The state anxiety score and heart rate were measured to check the stress manipulation. The time taken to finish a trial was measured as an index of performance time. The movements of participants' right hands were videotaped and categorized on the basis of the characteristics of interpersonal coordination failures. The numbers of concessions and collisions in acquisition and test trials were measured as an index of interpersonal coordination failures. The results indicated successful stress induction indexed by significant increases in state anxiety ($t = 3.46$, $p < .05$) and heart rate ($t = 2.23$, $p < .05$) under pressure. Although the performance time improved during the acquisition trials (F (4, 36) = 14.34, $p < .05$), it was not hindered under pressure. Movements were classified into five types of concession behaviors, one type of collision behavior, and four types of mixed behaviors of concessions and collisions. The number of concession behaviors decreased during acquisition trials ($\chi^2 = 10.55$, $df = 4$, $p < .05$), whereas the numbers of collision and mixed behaviors did not. None of the behaviors changed under pressure.

Directing attention externally by playing tag and its effects on sprinting performance

Ohsaki, Keisuke, Keio University

The present study aimed to investigate whether changes in attention focus could alter sprinting performance. Numerous studies have shown that adopting external focus of attention enhances performance skill. Recent studies have also found that the physical activities that are often used as a variable to evaluate physical fitness level such as vertical or long jump, as well as agility performance, can be enhanced by adopting external focus strategy. Although sprinting ability is one of the core components of many athletic events, athletes as well as the coaches often use an internal focus of attention to perform or give a feedback. And relationship between attention focus and sprinting performance has not been thoroughly investigated. The current research tries to manipulate participants' attention by conducting a "tag game" on a straight line. Each participants ($n = 8$) completed a 30 m sprint for five times in each of the three conditions (control, escaping and chasing). In the treatment condition, the participant had to either chase, or escape from another subject after the signal. By including chasing and escaping conditions, the subjects' attention was focused in front or behind, thereby externally focusing their attention. An interview after the all trials was conducted for the manipulation check. Preliminary analysis revealed that sprint time tends to be faster for control condition, although no significant differences were found among these three conditions. And most of the participants used internal focus in the control condition and external focus in the other two conditions. And no changes in other variable such as step length and frequency, and supporting and non-supporting time were observed. The results suggest that it may be difficult to adopt an external focus strategy to enhance sprinting performance. Instead, it supports the current sprint training methodology. The reason for slight decrement in performance by adopting external focus strategy will be discussed and implication for future research was stated.

Structure of variability in motor learning performance: Effect of the moment of occurrence

Pacheco, Matheus M.; Ambrósio, Natalia F. A.; Basso, Luciano; Tani, Go; University of São Paulo

Introduction: The decrease in movement variability with learning has been construed as evidence for optimization of the mean-end process; nevertheless, variability is never entirely eliminated. Current theories in motor behavior have a new approach to variability, arguing that this aspect provides meaning to flexibility. However, one question that needs to be answered is how these two aspects are associated. In addition, some authors state that variability in different points of time in the acquisition phase could have different meanings. This study analyzed the effect of the structure at different points in time on the flexibility in motor behavior. Methods: 61 children aged between 10 and 13 years performed a tracking task with a 5-key sequence, attempting to achieve one entire trial with anticipatory responses. In the practice phase, each stimulus was presented with an 800-ms interval between every two stimuli. This phase was analyzed in three blocks of trials. In the transfer test, the interval time was modified in a different way at each of the five intervals (600 to 800 ms), including ten trials exclusively. The Spearman's ρ correlation between the successive trials in a time series was applied to analyze the structure of variability. This analysis was also conducted independently from the blocks. Individual correlation coefficients were used to classify the structure of variability: structured (above 0.05) or unstructured (below 0.5). The performance found in the transference phase enabled us to assess the behavior of flexibility. Logistic regression was performed with the level of flexibility as dependent variable and the structure of variability as independent variable. Results: The regression showed an effect of the structure in the second block of the practice phase ($p = 0.025$; OR = 3.538, 95%CI = 1.13/10.99). Conclusion: The results found in this study were considered to be in agreement with the hypothesis that variability structure predicts the flexibility of the system, although this depends on the moment of its occurrence.

How different sources of visual perceptual information shape intentions, perceptions, and actions during one-handed catching

Panchuk, Derek, Victoria University; Davids, Keith, Queensland University of Technology; MacMahon, Clare; Sakadjian, Alex; Parrington, Lucy; Victoria University

Van der Kamp and colleagues (2008) contended that interceptive actions involve the integration between separate, yet complimentary, cortical pathways responsible for visual perception. The ventral stream is proposed to be responsible for object identification and determining an intended response, while the dorsal stream is considered to be responsible for ongoing regulation of action. These ideas imply that manipulation of different information sources during performance of an interceptive action might lead to the emergence of distinct movement pattern profiles. In this experiment we examined these ideas by studying hand kinematics and eye movements of participants as they attempted to catch balls projected from a novel apparatus that coupled video of a throwing action and a ball projection machine. Participants coordinated their actions in three conditions: no video—ball projection only; matching condition—ball projection synchronized with video of an actor throwing a ball; mismatch condition—ball projection speed not synchronized with video of the throwing action. Results revealed that patterns of hand movements and gaze behaviors were influenced by absence of perceptual information of the throwing action; movement initiation

occurred later, the hand moved faster, and reached its maximum grip aperture faster in the no video condition (ball flight only). Fewer image areas were sampled, tracking began later, and less of the ball's trajectory was tracked in the no video condition as well. There were no performance differences between the matching and mismatch image synchronization conditions. Data were congruent with contentions of Van der Kamp and colleagues (2008), demonstrating that advanced perceptual (ventral) information is important for shaping intentions, perception and action regulation, while ball flight (dorsal) information is mainly used to guide action during task performance.

Interaction of sequence coding and control schemes

Panzer, Stefan; Ellenbuerger, Thomas; Saarland University; Shea, Charles H., Texas A&M

An experiment was conducted to determine the extent to which the mode of control can be effectively shifted from on-line (OL) to pre-planning (PP) processes and from PP to OL as a result of the feedback available during testing. The task was to reproduce a 2000 ms spatial-temporal pattern of elbow flexions and extensions. Participants were randomly assigned to one of two practice conditions termed OL or PP. In the OL condition the criterion wave form and the cursor were provided during movement production while this information was withheld during movement production for the PP condition. Half of the participants in each acquisition conditions were administered to a retention test and two effector transfer tests under OL conditions and the other half under PP conditions. The mirror effector transfer test required the same pattern of muscle activation and limb joint angles as required during acquisition. The non-mirror transfer test required movements to same visual-spatial locations experienced during acquisition. The results indicated that participants in the OL condition outperform those at the PP condition during acquisition. More importantly, on the retention and transfer tests OL participants had lower RMSE errors on the non-mirror transfer test regardless of whether the test was administered under OL or PP conditions. These results demonstrate that participants provided OL feedback during acquisition outperform participants who practiced under PP conditions when tested under PP conditions when visual feedback was not available.

Coding multi-element movement sequences

Panzer, Stefan; Ellenbuerger, Thomas; Saarland University; Shea, Charles H., Texas A&M

The purpose of the present experiment was to determine the impact of visual information in coding an 8-element (S8) and two 16-element movement sequences (S16A, S16B). The 16-element sequences differed in terms of the regularities in the movement pattern (S16B is more regular or rhythmical), while the specific elements and number of reversals were held constant. The S16A sequence although composed of more elements required the same movement pattern as the S8 sequence. Participants produced the sequences by moving a lever with their right arm/hand to sequentially presented target locations. An inter-manual transfer paradigm with a retention test and two transfer tests was used; a mirror transfer test where the same pattern of muscle activation and limb joint angles were required and a non-mirror transfer test where the visual-spatial pattern of the sequence was reinstated. Following the administration of the retention and transfer tests a second round of tests was administered to the participants while vision was occluded. Consistent with findings from earlier experiments the results demonstrated better performance for the group who performed the S16B sequence under the vision and no vision condition compared to the

groups that performed the S8 and S16A sequences. Further, retention and transfer performance in the non-mirror test was superior for all groups compared to the mirror transfer test. This indicates that the sequence regardless of the number of elements or regularity in the sequence was coded in visual-spatial coordinates. This is consistent with the finding that the withdrawal of visual information negatively affected retention and the non-mirror transfer performance for all groups.

A study of haptic perception accuracy related to variability depending on perception-action coupling

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Background: Everyday behavior is controlled by a simple coupling between action and perception (Gibson, 1979). Many sports involve aligning a hitting implement with a ball trajectory such that a successful strike is made by haptic perception rather than by visibly distinct information (Carello et al., 1999). Purpose: This study measures whether perception-action coupling (PAC) influences the haptic perception ability in racket sports. Methodology: For the experiments, the haptic perception accuracy levels of five male table tennis experts and five male novices were examined under two different conditions (perception-action-uncoupled and perception-action-coupled conditions). In addition, we directly investigated the variability at the moment of contact of the ball with the racket. Visual control during movement execution was prevented by the use of an opaque curtain. Two-way analyses of variance (ANOVA) of the data were used to determine the uncoupled and coupled haptic perception accuracy and variability associated with expertise. Results: The conclusion of this research shows that the expert-level players acquire higher accuracy with lower variability than novice-level players, especially in perception-action coupled performances. The important finding from this result is that, in terms of accuracy, coupled action influences haptic perception ability more than uncoupled action. To explain the origin of the differences between experts and novices, one can use variability as a reference. Conclusions: The findings of this study provide evidence that haptic perception accuracy is related to variability depending on PAC. This is an important finding in the field of racket sports expertise.

The differentiated effect between self-controlled group and modified yoked group on golf putting task

Park, Sang Hoon; Hong, Seog Beom; Lee, Jung Eun; Yook, Dong Won, Yonsei University

The aim of this study was to reconfirm learning effect of self-controlled feedback, whose results have been controversy over different variables, and to compare it with learning effect of the group yoked with self-control group but who could choose on reception of feedback on golf putting task. The subjects of the current study were 40 right-handed male students of Y university in S city who had no experience in golf putting task. The subjects were randomly assigned to 4 groups of 10; self-control group (SC), yoked with self-control group (YSC), traditional-yoked group (TY), and control group (C). Each experimental design of acquisition phase was 4 (group) $\times$ 10 (block) factorial design and retention and transfer tests were 4 (group) $\times$ 2 (block) factorial designs. Two-way ANOVA with repeated measure on blocks was conducted. The results can be summarized as follows: First, there was differentiated learning effect in golf putting performance between groups (SC, YSC, TY, and C). Second, SC and YSC showed significantly better performance and learning than TY and control group in retention and transfer test. Finally, significantly better performance and

learning was shown in YSC than SC in transfer test. The result of this study ascertained the excellence of the SC in golf putting task, and presented the possibility of YSC mode (giving limited number of feedback and providing the choice whether to receive feedback) being more effective in learning than the SC mode.

Singer's five-step approach: Does every bit count?

Perreault, Melanie E., University of South Carolina; Eccles, David W., Florida State University

The purpose of this study was to determine the relative effectiveness of each substrategy of Singer's (1988) Five-Step Approach (5-SA) for learning a self-paced motor task in an attempt to understand better which substrategies are responsible for producing changes in performance and learning. The 5-SA is a learning strategy previously shown to enhance the learning of self-paced motor tasks and consists of five substrategies: (1) readying, (2) imaging, (3) focusing, (4) executing, and (5) evaluating. It was hypothesized that the addition of each substrategy of the 5-SA would cause a significant increase in performance during a retention test. Male (n = 43) and female (n = 77) undergraduate and graduate students ages 18 to 44 participated. Participants were randomly assigned to one of six gender-stratified groups. Group 1, a control group, received no training in the use of the 5-SA strategy. Groups 2-6 were trained, respectively, to use from the 5-SA (a) the readying substrategy, (b) the readying and imaging substrategies, (c) the readying, imaging, and focusing substrategies, (d) the readying, imaging, focusing, and executing substrategies, and (e) all substrategies. Participants performed a cup-stacking task requiring 6 cups to be stacked in a specific sequence as fast as possible for 50 trials in an acquisition phase and for 20 trials in a retention phase. While manipulation checks provided some evidence that participants used the strategies they were taught, no significant differences between groups on performance time were found in retention. Consequently, there is no evidence to suggest that partial or full use of the 5-SA is more effective for learning a self-paced motor task than using no strategy at all. These findings are important because they are discrepant with those of previous studies of the 5-SA that have involved almost identical study designs. If the 5-SA is to be recommended as a learning strategy for self-paced motor tasks, it is vital that all research, both supporting and refuting the strategy's effects on learning, is taken into account.

The effects of attentional resource allocation and skill level on movement variability and performance during a handgun shooting task

Petushek, Erich; Suss, Joel; Ward, Paul; Roemer, Karen; Michigan Technological University

Increasing attentional demands using secondary tasks has detrimental effects on primary psychomotor task performance, especially in novices. However, experts can reduce these effects to maintain their level of performance across task conditions. What is less clear, however, is the effect of increased attentional demand on movement variability across skill levels and how this may differentially affect novice and expert performance. Twelve expert and 19 novice shooters fired live ammunition at a target under a single-task (ST) and two dual-task conditions, extraneous (EX) and skill focused (SF), which have differential effects on performance. For distraction in the EX condition, participants verbally discriminated between high, mid, and low frequency auditory tones. To direct their attention inwardly in the SF condition, one of three locations of their trigger finger was verbalized upon tone

sound. No differences in accuracy and precision were observed between skill groups in the ST condition. Experts maintained shooting performance in all three conditions ($p > 0.05$). However, novices' performance decreased in the EX compared to ST condition ($p < 0.05$) and they were less accurate and precise compared to experts in both dual-task conditions ($p < 0.05$). The secondary task had differential effects on kinematic variability that may have uniquely impacted performance for each group. In the ST condition, experts' within-trial shoulder, elbow, and upper- arm angle variability across trials was significantly lower compared to novices ($p < 0.05$). Skill-based differences in kinematic variability were not observed across dual-task conditions. However, the effect size data indicate that while kinematic variability increased for experts in both dual-tasks relative to baseline ($d = 1.2$-1.4) it decreased for novices ($d = 0.3$-0.5). These data suggest that where experts positively exploited this increase in kinematic variability to maintain the same level of accuracy and precision across all three conditions, the novice strategy of freezing degrees of freedom hindered their shooting performance.

Are the action execution, imagery, and observation of intransitive movements equivalent?

Pilgramm, Sebastian; Lorey, Britta; Naumann, Tim; Bischoff, Matthias; University Giessen; Zentgraf, Karen; University Münster; Munzert, Joern; University Giessen

It is hypothesized that action execution, imagery, and observation are functionally equivalent (Jeannerod, 2001). This led to the major prediction that these motor states are based on the same action-specific and even effector-specific motor representations. The present study examined whether hand and foot movements are represented in a somatotopic manner during action execution, imagery, and action observation. During fMRI-scanning 18 paticipants (9 female) ran through ten experimental conditions: three execution conditions, three imagery conditions, three observation conditions, and one baseline condition. In the nine experimental conditions, participants had to execute, observe, or imagine right-hand extension/flexion movements or right-foot extension/flexion movements. The fMRI results showed a somatotopic organization within the contralateral premotor and primary motor cortex during motor imagery and motor execution. However, there was no clear somatotopic organization of action observation in the given regions of interest within the contralateral hemisphere, although observation of these movements activated these areas significantly.

Directing attention externally improves untrained sprinters performance, but not the performance of skilled sprinters

Porter, Jared M.; Sims, Blake; Crossley, Richard M.; Knopp, Seth W.; Southern Illinois University Carbondale

Numerous studies have demonstrated that directing attention externally rather than internally enhances motor performance and learning. To date, no studies have investigated the effects of attentional focus on sprinting performance. The purpose of the current study was to investigate if directing attention externally, in both untrained and trained populations, enhanced sprinting performance compared to directing attention internally or neutrally. Using a counterbalanced within participant design, untrained ($N = 70$) and trained ($N = 9$) participants completed 9 trials of a 20-m dash following instructions designed to induce an external (EXT) and internal (INT) attentional focus. In addition, participants completed

sprints following a control (CON) set of instructions inducing no specific focus of attention. Movement time was measured using infrared timing gates. CON instructions were "please run the 20 meter dash with maximum effort." INT instructions, which were adopted from a popular track and field coaching book, were "while you are running the 20 meter dash with maximum effort, focus on gradually raising your body level. Also, focus on powerfully driving one leg forward while moving your other leg and foot down and back as quickly as possible." EXT instructions were "while you are running the 20 meter dash with maximum effort, focus on gradually raising up. Also, focus on powerfully driving forward while clawing the floor with your shoe as quickly as possible." Results revealed the untrained participants ran significantly faster following the EXT instructions. However, trained participants displayed performance benefits while in the CON condition. Findings suggest untrained sprinters can enhance their performance by directing their attention externally. However, skilled sprinters should be allowed to choose their preferred focus of attention.

Biasing expectations negate the benefits of an external focus of attention

Porter, Jared M.; Westphal, William; Southern Illinois University Carbondale; Wu, Will F.W.; California State University, Long Beach; Hankey, Kaitlyn M.; Southern Illinois University Carbondale

Previous research has demonstrated that focusing one's attention externally and at increasing distances from the body enhances performance of a ballistic action (Porter, Anton, & Wu, in press). Moreover, recent findings have demonstrated that biasing expectations also enhances performance (Lohse & Sherwood, 2011). The purpose of this study was to investigate how biasing performers' expectations while eliciting different attentional focus affects standing long jump performance. Participants were college-aged students with no prior jump training. Using a mixed methods design, participants completed multiple trials of a standing long jump following verbal instructions promoting different attentional foci. When participants were in the Internal condition they were instructed to, "focus on extending your knees as rapidly as possible." When participants were in the External-Near condition they were instructed to, "focus on jumping as far past the start line as possible." The start line was located directly in front of their feet. When participants where in the External-Far condition they were instructed to, "focus on jumping as close as possible to the cone." The cone was place directly in front of them at a distance of 3 m. Participants completed two trials in each condition. In order to bias the participants' expectancy, each participant was told, in one of the counterbalanced experimental conditions, "you should have your best jumping performance in this condition." Results of the attentional focus factor revealed that both external focus conditions jumped significantly further than the internal condition with the External-Far condition jumping the furthest. When bias was introduced, jumping differences were not observed in either condition. Findings of this study indicate that the typical results observed within the attentional focus literature are negated when expectations of their performance are biased.

Self-Controlled practice facilitates the learning of a novel motor skill

Post, Phillip G., New Mexico State University, Las Cruces; Barros, Joao A. C., California State University, Fullerton; Fairbrother, Jeffrey T., University of Tennessee, Knoxville; Kulpa, John B., New Mexico State University, Las Cruces

A growing body of research demonstrates that learning is enhanced when learners have self-control (SC) over aspects of the instructional design. Benefits of SC have been demonstrated

with augmented feedback, video demonstrations, and physical guidance (Wulf, 2007). However, recent research suggests that the benefits of SC may also generalize to other aspects of the instructional design. Post, Fairbrother, and Barros (2011) showed that SC over amount of practice also facilitates learning. Despite the benefit of SC over amount of practice (SCAP) in the previous study, participants in the SC group chose to complete 20-100 practice trials, far too few to master the task. Thus, it may not be advantageous to give learners such complete control. Instead, Post et al. suggested that it might be beneficial to give SCAP within a larger instructor-defined structure. The purpose of the present study was to examine the influence of SCAP within a mandated number of acquisition blocks. Participants were 30 female college students assigned to SC and yoked (YK) groups to learn a basketball set-shot. Each participant in the SC group was matched to a counterpart in the YK group so that both received the same number trials within two fifteen-minute acquisition blocks. Retention and transfer tests were given after 24 hr. Both groups showed improved form and accuracy scores across acquisition blocks ($p < .001$). During retention, the SC group had higher form and accuracy scores than the YK group ($p < .05$). Additionally, the SC group was more accurate than the YK group in recalling the number of trials they completed during acquisition ($p < .05$). These findings extend earlier research by showing that the benefits of SCAP generalize to situations in which learners do not have sole control over their practice duration. The results also suggest that SCAP may be maximized when the instructor defines the parameters of the practice duration, given that learners in the present study showed greater mastery of the task compared to learners in the Post et al. (2011) investigation.

Light touch improves the integration between posture and manual control

Raffegeau, Tiphanie; Ryu, Joong Hyun; Haddad, Jeffrey M., Karstetter, Steven; Purdue

Lightly touching an object, below a threshold that provides mechanical support, reduces postural sway during quiet standing (Jeka & Lackner, 1994). This light touch effect has been observed under a variety of paradigms. For example, light touch reduces postural sway regardless of the orientation (Rabin et al., 1999) and location (Krishnamoorthy et al., 2002) of the touch surface, or whether the light touch is actively (Jeka & Lackner, 1994) or passively (Rogers et al., 2001; Riley et al., 1999) applied. Despite the robust findings of light touch on quiet stance, little research has examined if light touch influences balance while performing a supra-postural task. If light touch stabilizes balance, supra-postural task performance may improve. Therefore, this study examined if light touch influences balance and performance of a standing precision manual task. Fifteen adults (7 males and 8 females; avg = 21 years) were recruited. Participants were instructed to trace a letter on paper (touch), or the cut-out of a letter (open), placed at shoulder height. The touch trials were designed so the paper would push out of its frame if more than 1 N of force was applied. The precision demands (tracing with a large or small stylus), and postural difficulty (tracing at arm's length or 133.3% arm's length) of the task were also manipulated. Center of pressure standard deviation was significantly larger ($p < .05$) in the touch trials (AP = 5.19 mm, ML = 5.58 mm) compared to the no-touch trials (AP = 4.22 mm, ML = 4.64 mm). Accuracy of the task significantly improved ($p < .05$) in the touch (11.5% error) compared to no-touch trials (88.5% error). No interactions of touch by precision or postural difficulty were observed. The increased sway during touch trials was counterintuitive, given past research that showed light touch reduces sway. However, given the subjects' improved accuracy, light touch may have resulted in the generation of body movements

that improved the flexibility of the postural system so that the task was more efficiently and accurately performed.

Motor task encoding and cognitive effort

Raisbeck, Louisa D., Michigan Tech; Wyatt, William, Indiana University; Shea, John B., Indiana University

Research findings on mental (MP) and physical (PP) practice are inconclusive regarding the effects of MP on the cognitive and motor processes underlying performance. This study considered the effect of instructions to learn on task execution for MP and PP. Four groups ($N = 24$, $n = 6$) were used in the study: MP with instructions (MPI); MP with no instructions (MPNI); PP with instructions (PPI); and PP with no instructions (PPNI). Subjects performed 20 practice trials of a 4-button pressing task in response to a stimulus light as fast as possible. After a 20-min filled retention interval subjects performed 2 retention tests (RT1 and RT2) of 4 trials. A task diagram was not presented during RT1, but was presented for RT2. To assess perceived workload the NASA-TLX survey was administered immediately following practice and retention trials. A MANOVA showed that TLX scores for MP were higher than PP (t 39 = 2.71, $p = .01$). A spearman correlation revealed a negative relationship between accuracy and TLX scores. Subjects reporting lower levels of task complexity, had higher levels of accuracy for RT1, $r^2 = -.321$, $p = .04$. Also, MP subjects rated mental demand (t 39 = 4.28, $p = .02$), effort (t 39 = 2.99, $p = .05$), and frustration (t 39 = 2.32, $p = .026$), higher than PP subjects. The performance and perceived effort data suggest that a no pattern retention test is both physically and mentally more demanding for subjects using mental practice alone. Also when subjects are informed about a retention test they are unable to alter their performance or sense of task complexity. Raisbeck, Wyatt, and Shea (in press) speculated that mental practice is more effortful than physical practice. The findings of the present experiment support and extend this speculation by showing mental practice results in greater mental and physical effort.

Describing how vision is used in gait by tracking head motion

Remelius, Jebb G., VanEmmerik, Richard E.A.; University of Massachusetts

When sighted individuals walk, they use visual perception to guide the formation of each step. The role of vision in gait is commonly described using gaze tracking. However, gaze information cannot include the context of how the field of view (FoV) as a whole behaves, a feature that may relate to the perception of self-motion. The purpose of this research is to better understand the dynamics of the FoV limits in walking gait. FoV dynamics are driven by the six degrees of freedom movement of the head relative to the environment that are difficult to describe individually. Proposed here is a single transverse plane measure, the proximal visual intersect (PVI), to assess dynamics of the head in relation to the lower FoV limit. The PVI was obtained through a projection (-65°) from the neutral plane of the head (the Frankfurt plane) onto the ground. Motion capture was used to track the head neutral plane as part of a 13-segment model of the whole body center of mass in 20 young healthy adults while walking overground at preferred speed (4 trials). The PVI described the anterior progression and the proximity of the lower FoV limit to the body during gait. FoV quasi-fixations were identified by a local PVI anterior velocity minimum for each step. The PVI anterior velocity minimum systematically occurred at 29% (*SD*) of swing, located 0.69 cm (*SD*) anterior to the CoM. These results show that multiple degrees of freedom dynamics

of the head coalesce during swing to systematically slow the anterior sweep of the FoV in the swing phase of gait, and that the lower limit of the FoV is closest to the body at this PVI anterior velocity minimum. The dynamics of the FoV revealed with the PVI measure illustrate a per cycle slowing of the anterior progression of the visual field that may afford a more comprehensive evaluation of the environment proximal to the body and the self-motion of the body during a step. The proximal visual intersect is potentially an efficient single measure to depict head movement related to the perception of the environment and may have clinical applications.

Gait dynamics in individuals with chronic stroke following variable speed treadmill training

Rhea, Christopher K., University of North Carolina at Greensboro; Wutzke, Clinton J.; Lewek, Michael D.; University of North Carolina at Chapel Hill

A goal for gait rehabilitation following stroke is to restore functional mobility, which encompasses the ability to avoid stationary or moving obstacles, as well as changes in slope. Because variable practice interventions may encourage gait variability, it may be more beneficial at restoring functional mobility than constant practice conditions. Recent research, however, has suggested that it is not the amount of variability in gait that relates to functional mobility, but the dynamic properties as gait control is evolving (i.e., structure of the variability). This study examined the influence of a variable practice intervention on gait dynamics during treadmill walking. Subjects ($N = 16$) with hemiparesis following chronic stroke walked on a treadmill for 15 min in constant speed training (CST) and variable speed training (VST, changed treadmill speed every minute). Gait dynamics for 2 min before and after CST and VST were examined in the hip and knee sagittal plane angles using sample entropy and detrended fluctuation analysis. No differences were observed between the two conditions ($p > 0.05$), indicating that a single session of VST did not immediately influence the gait dynamics. Future studies will examine VST on a more micro-level, such as inducing changes in speed from stride-to-stride rather than from minute-to-minute.

The effects of specific and non-specific cues on decision making during situation awareness: ERP study

Ryu, Kyungmin, Kyungpook National University; Kim, Jingu, Kyungpook National University; Woo, Minjung, University of Ulsan; Kwon, Eunjean, Kyungpook National University; Lee, Hanjoon, University of Ulsan

The purpose of this study was to examine the effect of providing specific and non-specific cues on decision making in tennis athletes during situation awareness. Participants were thirty six male college students who were randomly assigned to one of three groups: (1) a non-specific cue group, (2) a specific cue group, and (3) a control group. Every participant was in the level 3-4.5 according to American National Tennis Level Program. Participants were asked to watch tennis single defence, single offence, double defence rally and they were required to push the button(left, middle, or right) as they predicted the direction of ball as soon as possible when the image was paused. Reaction time, accuracy rate, and amplitude and latency of P300 were subjected to three (group) × three (condition) × seven (area) ANOVA with repeated measures of condition and region. The analysis revealed that the latencies and amplitudes of the non-specific cue group and the specific cue group were shorter and higher than those of the control group. Especially, amplitudes at Fz, Cz, Pz were prominent

relative to other areas and amplitude in the single defence condition was greater than those in the single offence and the double defence condition. Based on the result of present study, it seems plausible to conclude that both non-specific and specific cues are directly influence on information processing of tennis athletes. Additionally, event-related potential seems to be a useful index to examine the process of situation awareness and decision making.

Learning a dynamic perception-action coordination skill with an environmental cue

Ryu, Young Uk, Catholic University Daegu

Visuomotor tracking tasks have been used to elucidate the underlying mechanisms that allow for the coordination of a movement to an environmental event. Recent studies (Ryu & Buchanan, 2009, 2012) have demonstrated that environmental information, such as signal presentation and display mode, might play a role to produce required visuomotor coordination patterns. The main purpose of the present study was to examine an influence of environmental information on learning a visuomotor coordination pattern. Participants were asked to learn a 90° tracking pattern defined by phase relation between two dots. A computer monitor displayed two dots moving horizontally. A computer generated the top dot, which was set at 0.8 Hz with 8 cycles in a trial, while a participant moved the bottom dot from side to side using a joystick. There were two background groups to present two dots, a control group with the white background and a grid group with a square grid on the white background. Two-day sessions consisted of a total of 72 practice trials. Retention test was conducted on day 3 with the white background for both groups. Results demonstrated that the grid group produced more accurate and stable tracking during practice and retention. Thus, the grid in the workspace played a role as an environmental cue to enhance the learning of the required visuomotor tracking pattern in the present study.

Easy to difficult progressions in practice do not always facilitate implicit learning

Sanli, Elizabeth A.; Lee, Timothy D.; McMaster University

Implicit motor learning has been studied using a protocol that consists of progressively more difficult versions of a task during acquisition (see Poolton & Zachry, 2007, for review). Studies examining gross motor skills in adults have found that this protocol typically results in less error than a reverse order protocol during acquisition, as well as better performance on retention and dual-task tests. In the current experiment, twenty young adults were asked to propel a 3-cm-diameter disc towards a series of 6.5-cm-diameter targets which were projected onto a table top. Participants followed either a progressive or reverse protocol. Contrary to previous studies, those following the reverse protocol committed fewer errors in acquisition than the progressive protocol. Further, while there were no main effects for protocol in immediate and delayed retention and dual task tests, those that followed the reverse protocol committed significantly fewer errors in the transfer test than those that followed the progressive protocol. We discuss these findings in terms of the use of progressive and reverse as a procedure to induce implicit motor learning in fine motor skills.

Acute effects of assistive device use on muscle activation patterns in children with myelomeningocele

Sansom, Jennifer K.; Ulrich, Beverly D.; University of Michigan

Introduction: Children with myelomeningocele (MMC), a form of spina bifida, have sensorimotor deficits of the legs contributing to difficulty with posture and gait control, often

requiring assistive device (AD) use for safety when walking. Many of these ADs restrict normal arm motion and may, over time, contribute to gait maladaptations. However, we know little about acute AD use on muscle activity while walking. Our goal was to record muscle activity of 4 muscles while children with MMC walked with 3 ADs. Method: We tested 9 (5 girls), 5-12 year-old children with MMC; 5 who wore ankle foot orthoses (AFOs) for everyday walking (Community Minus = C-), 4 did not (Community Plus = C+). Children walked overground at their self-selected pace in 4 conditions: independent (I), walker (W), crutches (C), poles (P); 3 trials/condition. EMG electrodes were placed on lower trapezius (LT), gluteus medius (GM), rectus femoris (RF), biceps femoris (BF); sampled at 1000 Hz. Data for AD conditions were compared to I walking results for each child. Results: Both groups showed increased variability across the cycle while walking w/ ADs compared to I but otherwise, C+ children showed no change in EMG patterns, timing and duration of muscle bursts. For children in the C- group, walking with C caused shifts to a single peak during end stance for RF, BF, and GM and decreased amplitude with shift to earlier onset for LT. Walking with W led to delayed onset during stance in RF and LT with shifts in RF activation to a single major peak near end stance. The P condition delayed onset of RF, BF, and GM during stance while LT increased amplitude across the cycle. Discussion: C+ children who did not need ADs varied but did not change, in the short term, their well-established muscle patterns. Children in the C- group showed they were able to adapt their muscle synergies, in real time, in a variety of ways. Future research needs to test whether these adaptations are advantageous or detrimental to safety or endurance and, the effect of practice with these devices on maintaining independent locomotion beyond the childhood years.

Muscle activity in infants with myelomeningocele: A retrospective examination based on age at walk onset

Sansom, Jennifer K., Universtiy of Michigan; Teulier, Caroline, Université Paris Descartes; Ulrich, Beverly D., University of Michigan

Introduction: Across the first year of life, infants learn, via practice, to control their limbs to accomplish movement goals. Infants with myelomeningocele (MMC) have sensorimotor deficits that delay walking onset and contribute to difficulties with gait control, yet significant variability exists within this population. To optimize motor outcomes, we need to understand how early muscle activity responses to movement contexts may reflect the level of deficit and relate to rate of skill acquisition. Here we compare the muscle activation patterns of infants with MMC when supported on a treadmill (TM) as a function of whether they were early or late walkers (< 24 mo vs. > 24 mo). Method: We tested 10 infants with MMC at 6, 12, 18 months, (early walkers $n = 5$). We placed EMG electrodes on lateral gastrocnemius (LG), tibialis anterior (TA), rectus femoris (RF), biceps femoris (BF), sampling at 1200 Hz. Infants stepped for 12-20 s trials at 6 speeds. Follow-up visits confirmed walk onset. For each baby/age we included from 1 to 4 strides for analyses. Results: Step characteristics: early walkers showed earlier and more consistent use of heel and flat-foot contact at touchdown and midstance, respectively, with age. EMG patterns: with age, early walkers produced less passive motion and more activity in single and combinations of multiple muscles during stance than late walkers. Agonist-antagonist co-activation was higher for infants who walked early vs. later with age; with age, early walkers tended to decrease co-activation during stance and swing while late walkers increased co-activation. By 12 months, those who became early walkers produced more LG muscle activity than

later walkers. Discussion: Our results show that the treadmill context may be useful to identify infants with MMC who will benefit from therapies focused on gait and muscle control. Future intervention studies and therapies that emphasize development of strength and control of LG, in particular, may be useful.

Does focus of attention really matter during motor learning in old age?

Santos, Suely; Franzoni, Mariana M.; Nunes, Marcelo E S.; Souza, Marina G. T. X.; Monteiro, Carlos B. M., University of Sao Paulo

Focus of attention has been presented as a factor that can promote qualitative superior performance and speed up learning while individuals could adopt automatic patterns of control. In the other hand, there are some evidences that, during the learning process, elderly tend to direct attention toward to their body movements in an online movement control mode, which it has been associated with not efficient muscle system activation, and an inhibition of an effective automatic process of control. Thus, the objective of this study was to examine whether the adoption of a focus of attention, internal (IF) and external (EF), could affect the learning process of a motor skill in old age. Two groups with 20 individuals between 60 and 75 years old performed darts throwing toward a static target. Results showed that although the two groups have improved performance with practice and were able to learn, EF group showed discrete advantage during initials stages of learning. Despite of that, there were also some indicatives that when instructions were repeated during the acquisition, perhaps it could have taken EF group off from the automatic control, causing performance decrease. Considering that the performance differences found at the beginning of learning did not maintain, particularly, in the retention test, it is not possible to accept the hypothesis that the external focus is favorable in darts throwing learning in old age.

The influence of online perturbations on the integration of sequential movements

Sarteep, Salah, Bangor University; Khan, Micheal A., University of Windsor; Mottram, Tom M., Bangor University; Buckolz, Eric, University of Westen Ontario

Movement times to the first target in a multiple target sequence are typically longer than movement times to a single target. It has been proposed that this lengthening of movement time is a consequence of additional control processes associated with the implementation of the second segment during execution of the first segment. In the present study, we compared the costs associated with adjusting movement trajectories following a change in target location in both single and two target-aiming movements. Participants performed aiming movements to a single target, two-target movements in which vision was available for both segments, and two-target movements in which vision was occluded at the end of the first segment. For each aiming task, the location of the first target either remained fixed or was perturbed at movement onset. On perturbed trials, the first target was shifted either closer to or further from to the start position. Linear regressions of error versus movement time on perturbed trials revealed greater *y*-intercepts for the two target conditions compared to the single target condition. Hence, the cost in movement time associated with adjusting aiming trajectories following a change in target location was greater when participants were required to aim to a second target. This result demonstrates that aiming movements in a sequence are not controlled independently and that error correction processes are subject to competition from overlapping processes associated with implementation of the second segment during execution of the first segment.

Influences of pressure on anticipatory postural adjustment in a single forward step

Sasaki, Joyo; Sekiya, Hiroshi; Hiroshima University

The objective of the present study was to investigate the influence of pressure on the anticipatory postural adjustment (APA) of a single forward step. Fourteen participants made a single step toward a circular target (10 cm in diameter) in response to a beep sound; ten trials each under pressure and non-pressure conditions. In performing the task, participants were required rapidity of response to the beep sound, brevity of the stepping movement, and accuracy of the landing position on the target. Pressure was induced by the presence of a small audience as well as false instructions regarding having to repeat the same experiment on another day and the consequence of presenting the participants' video-taped performance at a sports science lecture should the participants' performance not reach set criteria. The results showed that the state anxiety (state-trait anxiety inventory: STAI Y-1) increased from 42.4 (±7.0) to 53.7 (±8.7) ($p < .01$) and the heart rate also increased from 76.2 (±7.0) bpm to 83.4 (±9.3) bpm ($p < .01$) under pressure. Significant increases in the mean radial error ($p < .05$) and bivariate variable error ($p < .05$) were found, indicating that the accuracy of the landing position was reduced under pressure. Furthermore, in the APA phase, the backward displacement of center of pressure ($p < .05$) and electromyographic activity levels of tibialis anterior in lower thighs ($p < .05$) increased significantly, indicating that APA was enhanced under pressure. These findings suggest that pressure altered the initial postural control of a single forward step and this change led to poor performance.

Emotional expression in dance: The cuboid model

Sawada, Misako, Japan Women's University; Suda, Kazuhiro, Tokyo Institute of Technology

This study investigated the relation between emotional expression and movement space characteristics in dance. Four female dancers ($M_{age} = 23.0$) with an average of 15.3 years of experience participated. They were asked to use their whole bodies to express three fundamental emotions (joy, sadness, and anger) for 5 s while being videotaped. Three-dimensional body locations were computed using the direct linear transformation procedure. In this study, the cuboid defined by the maximal and the minimal values of the markers on the *X*, *Y*, *Z* axes in each frame were used as an indicator of spatial characteristics and named S (spatial dynamism). Average, maximal, and minimal S values for each emotional expression were calculated, as well as maximal and minimal differential of S. As a result of ANOVA concerning the average and maximal value of S, the significant main effect of emotion was found ($p < .05$, $p < .01$). A Tukey multiple comparisons test indicated the average S of expressing joy was significantly higher than for sadness or anger ($p < .05$); and the maximal value of S was significantly greater for joy than sadness or anger ($p < .01$, $p < .05$). This means that expressing joy uses more space compared with the other emotions. In ANOVA for the maximal and minimal differential of S, the type of emotion exhibited a significant main effect ($p < .01$, $p = .05$). A Tukey multiple comparisons test showed that the maximal differential of S was significantly higher for joy than for sadness or anger ($p < .01$, $p < .05$); and the minimal differential of S was significantly lower for joy than sadness ($p < .05$). Expressions of joy involved a quicker change of body space usage compared with the other emotions. The methods used to evaluate space characteristics in emotional dance expression were valid to distinguish between expression characteristics of positive emotion (joy) and negative emotion (sadness, anger). The results showed that expression of joy had larger spatial characteristics compared to other emotions.

The role of auditory and visual models in the production bimanual tapping patterns

Shea, Charles H.; Kennedy, Deanna; Boyle, Jason; Texas A&M University

Two experiments were designed to determine the role audio and visual models play in the learning of 2:1 (Experiment 1), and 3:2 (Experiment 2) bimanual tapping. In each experiment participants, with no formal music experience, were assigned to either a no-model, auditory model, visual model, or auditory-visual model condition. The task was to tap a left side force transducer with the left hand and a right sided force transducer with the right hand in attempt to produce the desired coordination pattern. The auditory model consisted of a series of tones that represented the temporal characteristics of the require tapping pattern. The visual model was a display that illustrated the relational characteristics of the required tapping pattern. The results indicated extremely effective performance of the bimanual coordination patterns for the auditory visual model condition with not only the relative but absolute characteristics of the model exhibited during retention testing with and without the model.

Optimizing control of ID = 6 movements

Shea, Charles H.; Kennedy, Deanna; Boyle, Jason; Texas A&M University

An experiment was designed to determine the degree to which instruction and visual information influence participants control and performance characteristics of an ID = 6 reciprocal Fitts task. Participants were asked to flex/extend their limb/lever in the horizontal plane at the elbow joint (wrist stabilized) in an attempt to move back and forth between two targets as quickly and accurately as possible (Fitts condition), between two target lines paced by a metronome (impulse variability condition), or track a sine wave pattern (sine wave condition). The timing for the impulse variability and sine wave conditions was set to result in movement times similar to that anticipated in the Fitts condition. The respective display and current position of the limb were projected on the screen in front of the participant. The first retention test was the same as that used experienced the initial practice and then all participants were asked to perform under the Fitts condition on the second transfer/retention test. The results indicated that movement time for the three groups did not differ. However, dwell time was significantly lower, time to peak velocity was significantly higher, and endpoint variability was significantly smaller for the participants in the sine wave condition than in either the Fitts or impulse variability conditions. On the second test, where Fitts conditions were imposed for all groups, the advantages for the sine wave conditions persisted but were reduced.

Effect of expertise and availability of target in throwing to a goalkeeper adopting Müller-Lyer postures

Shim, Jaeho; Rigby, Brandon R.; Lutz, Rafer, Baylor University; Van der Kamp, Jon; VU University

In our earlier study (Shim, Masters, Poolton, & Van der Kamp, 2010), we initially verified that throwing behavior toward a goalkeeper that mimicked an amputated Müller-Lyer illusion was related to misperception of goalkeeper arm length assumed to be associated with goalkeeper height. We then confirmed that the throwing behavior was indeed due to perceived goalkeeper height. However, it is believed that skillful actions are more autonomous and is less affected by illusory context information. Also, in other illusion studies, it is questioned if the misperception is caused by merely having to predict the target because it is

unavailable. The purpose of the study was to determine if the expert throwers were less prone to illusion and having a virtual target overrides the illusion. Fifteen male baseball players and 18 novice throwers participated. A 1.9-m animated representation of a goalkeeper was projected onto a blank screen. The goalkeeper was shown in an arms-up (45 degrees above horizontal), arms-out (horizontal), or arms-down (45 degrees below horizontal) posture. The baseball players threw to a predicted target (goalkeeper's horizontal reach) while the novices threw to a virtual target (goalkeeper's vertex). Expert throwers showed the same illusory effects as previous from the novices and the result showed a significant effect on posture $F(2, 28) = 16.42$, $p < .05$. When the novices had a virtual target to throw, the illusory effect disappeared ($p > .05$). It appears that experts are just as deceived by illusion when the target has to be predicted and that the illusion in far aiming task is significantly impacted by the availability of target.

Perceptual bias of direction in putting among expert golfers

Shim, Jaeho; Lutz, Rafer; Miller, Glenn; Baylor University

When addressing the putt, players must stand to the left or right of the line between the ball and the hole. This stance puts the players in an unnatural position to read the green and creates a perceptual bias because the head is positioned either to the left or to the right of and perpendicular to the line. The purpose of the study was to determine if expert golfers, known for their accurate putting performance, are immune to this perceptual bias which might apply to only novice players. Twenty-four expert golfers (27±13.7 years and +1.4±2 HI) participated and they either putted or aimed a line on the ball towards the target. In putting condition, they putted a ball 4 m from the hole as they normally would in a real situation of putting. In aiming condition, they setup to putt but the putter was taken away and they directed the line on the ball held by an experimenter to move either clockwise or counterclockwise so that it aims towards the target. Ten trials of putting and 10 trials of aiming were performed by each expert with the order counterbalanced. A camera was positioned 4 m above the ground just behind the ball to capture the line on the ball and SAM PuttLab system was used to measure the putter head angles at address and at ball contact. A special goggles (PLATO) was used to occlude vision immediately after ball contact. The aim with the line on the ball (0.7 degrees right of target) and the aims of the putter head at address (0.9 degrees right) and at ball contact (1.2 degrees right) were all similar and the difference was nonsignificant, $F(2, 40) = .13$, $p > .05$. There were also no gender difference and no eye-dominance effect ($p > .05$). The experts did not demonstrate perceptual bias and also their putting was uninfluenced.

Task complexity and KR frequency interact in children's motor skill learning

Sidaway, Ben; Bates, Justin; Occhiogrosso, Barbara; Schlagenhaufer, Jessica; Wilkes, Delany; Husson University

Providing adults with knowledge of results (KR) after each practice trial has generally been shown to be detrimental to motor skill learning when compared to conditions in which feedback is less frequently provided. Recent research has also shown that a reduced frequency of KR is beneficial for motor learning in children with cerebral palsy (Hemayattalab & Rostami, 2010). Some earlier work, however, found that in typically developing children frequent feedback may actually be necessary for optimal learning (Sullivan, Kantak, & Burtner, 2008). The role of KR frequency in children's motor learning is further explored

here by examining the learning of a throwing skill in typically developing fourth and fifth graders. Forty-eight children threw beanbags for accuracy at an unseen target. Two levels of task complexity were crossed with two frequencies (100%, 33%) of feedback provision. Task complexity was operationally defined using Gentile's motor skills taxonomy (Gentile, 1987) with children throwing either while walking or from a standing position. The children learned the tasks with feedback and then performed retention tests without feedback immediately and then one-week later along with transfer tests to assess the generalizability of learning. Analyses revealed that learning was improved for one version of the task when a 33% feedback frequency was provided during practice. In contrast, in the other version of the task, learning was facilitated by provision of a 100% feedback frequency. These results are taken as support for the Challenge Point Framework (Guadagnoli & Lee, 2004) wherein the greatest learning is exhibited at an optimal level of cognitive challenge. Structuring practice conditions for children then must take into account task complexity and feedback frequency in determining the optimal cognitive challenge for learning. More generally, the findings suggest that practitioners teaching motor skills should design practice conditions in accordance with the informational processing capacity of the learner.

Precueing about direction of postural perturbation does not improve postural responses in the elderly

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This study aimed at assessing the effect of precueing about direction of basis of support rotation on postural responses of elderly individuals. We evaluated physically active healthy males (n = 2) and females (n = 14), age range of 66-82 years old (M = 74). Experimental task consisted of keeping upright stance while a force platform was rotated to produce either plantar or dorsal flexion of the ankle. Four conditions were tested by combining the following factors: (a) direction of rotation schedule of the force platform, random versus blocked; and (b) precueing, provision versus no provision of precueing about direction of platform rotation. Precues were provided by means of upward or downward arrows to indicate upcoming ankle dorsal and plantar flexion, respectively, through a monitor positioned in front of the participant. Intervals between precueing and perturbation were variable and randomized, so that time of postural perturbation was unexpected for the participant. Sequence of experimental conditions was randomized across participants. Results showed that postural sway and EMG latency of the tibialis anterior and gastrocnemius muscles were not affected by precueing. Blocked trials led to progressive decrement of postural sway across trials for plantar flexion but not for dorsal flexion perturbations. No adaptation was observed for random sequences. These results suggest that immediate prior experience but not precueing about direction of perturbation affects reactive postural responses in the elderly.

Training advanced anticipation skill by removing dynamical information in the end effector

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Skilled anticipators can be differentiated from less-skilled counterparts by their use of information within body regions other than the end effector in order to predict movement

outcomes more reliably. How to train learners to use these additional regions has been the focus of research in this domain. Reducing the relationship between weakly reliable visual information and an outcome can result in the discovery of more reliable information sources. We tested this in a tennis anticipation task over two experiments. Anticipation accuracy was measured before and after anticipation training in tennis playing novices. In the pre and posttest dynamical information for shot direction was present in either, arm and racket, shoulders, hips, trunk, legs, or whole-body (control) body regions. In experiment one, the whole-body dynamical information for anticipation was manipulated to be contained in 50% of the training trials (Whole-body 50% group) and compared to consistent presentation of this information (Whole-body 100% group) and a group who did not receive any practice (Control group). Significant differences in pre-to-posttest performances were found in the Whole-body 100% group only, demonstrating consistent presentation of this information is important for skill learning. In experiment two, dynamical information was removed from either the end effector (Rest of Body group) or the rest of the body (End Effector group) and presented with all body regions visible. Both Rest of the Body and End Effector groups significantly improved their pre to posttest performance. Additionally, in the post-test, the Rest of the Body group was significantly more accurate on the whole-body control condition compared to the End Effector group whereas the opposite effect was found in the shoulder condition. These results show that removing dynamical information in body regions, but not consistency of this information promotes information pick up across body regions. Furthermore, it supports the notion of an information source that is generalizable across the whole body.

At what level of development do coaches and athletes think a skill acquisition specialist (SAS) would be most useful?

Steel, Kylie A., University of Western Sydney; Harris, Ben, Equestrian Australia; Baxter, David, Australian College of Physical Education; King, Mike, Australian College of Physical Education

Introduction: Skill acquisition is integral to sports performance and starts in the critical early years of development (Elbert et al., 1995); however, junior sports coaches are often volunteers with minimal accredited qualifications and such qualifications rarely include skill acquisition. Senior coach accreditations are more extensive though still lacking in skill acquisition theory. The purpose of this study was to examine whether institute-based coach and athlete attitudes reflect the coach accreditation content trend that skill acquisition knowledge is more useful at senior levels. Procedures: $N = 42$ volunteer participants, including 16 coaches (14 males; 2 females; 34-60 years) and 26 athletes (18 males; 8 females; 18-59 years). All participants coached or competed at a pre-elite level or higher in their sport and completed an electronic survey instrument. Results: Results were analyzed using both one-way chi-square for goodness of fit and 2-way chi-square for independence. Participants indicated they felt SAS were most useful at Junior (57%), and Pre-Elite (55%). None of these frequencies significantly departed from the expected, and there was no dependency on the selection of athlete level when analysed against respondent Gender, Player/Coach status, age, or sport category (invasion vs. individual). Discussion/Conclusion: Results indicate that participants believe SASs are important at all levels of performance. Despite this few SASs are utilized extensively at either junior or elite levels. Given the time critical aspects of skill learning it may be advisable for coach and athlete education programs to implement some reasonable level of skill acquisition content within national coaching accreditations,

especially at junior levels. References: Elbert, T., Pantev, C., Weinbruch, C., Rockstroh, B., & Taub, E. (1995). Increased cortical representation of the fingers of the left hand in string players. Science, 270, 305-307.

Coach, sport scientist or psychologist: How coaches and athletes perceive the role of skill acquisition specialists

Steel, Kylie A., University of Western Sydney; Harris, Ben, Equestrian Australia; Baxter, David, Australian College of Physical Education; King, Mike, Australian College of Physical Education

Introduction: Skill acquisition concerns processes explaining and promoting movement and perceptual development. This relates to functional concepts such as instruction, practice and feedback. Despites the wide use of these concepts by sports coaches, few athletes and coaches are exposed to this specialist domain despite regularly utilizing other established disciplines (Williams & Ford, 2009). Therefore, the purpose of this study was to investigate how the role of a skill acquisition specialist was perceived by athletes and coaches. Procedures: $N = 42$ (32 males; 10 female athletes (26) and coaches (16) aged 18-65 years), volunteered to participate in this study. All participants competed or coached at pre-elite or higher in their sport. The participants completed an electronically administered survey instrument. These data were then collected from the survey instrument source and analyzed. Results: The data was analyzed using descriptive statistics and chi-square for expected frequencies. Results indicate that 100% of respondents identify skill development as very or extremely important ($p < 0.001$). However, the coaches also perceived skill acquisition specialists as specialist coaches (66.7%), sport scientists (28.6%), and psychologists (4.8%) where $p < 0.01$ for expected frequency of each category. Discussion/ Conclusion: The results suggest that many athletes and coaches do not fully understand the role of a skill acquisition specialist. Given the relevance movement skills to the development of sports performance it may be useful for specialists, and coach and athlete educators to work together in the development of courses highlighting the usefulness of all areas of sport science in the development of expertise. References: Williams, A. M., & Ford, P. R. (2009). Promoting a skills-based agenda in Olympic sports: The role of skill-acquisition specialists. Journal of Sports Sciences (1), 1-12.

Why aren't skill acquisition specialists used more in sport by coaches in clubs and sports institutes?

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Introduction: Sport scientists who specialize in skill acquisition are interested in the theory and application of scientific processes that promote movement and perceptual development (Farrow et al, 2008). However, while coaches and athletes readily utilise services of many established sport science disciplines, they rarely do so in the area of skill acquisition. Therefore the purpose of this study was to identify the major barriers observed by coaches and athletes in the use of skill acquisition specialists. Procedures: $N = 42$ volunteers, including 16 coaches (14 males; 2 females) aged 34-60 years and 26 athletes (18 males: 8 females) aged 18-59 years, participated in this study. All participants coached or competed at a pre-elite level or higher in their sport. The participants were asked to complete an electronically

administered survey instrument, which contained 16 items taking approximately 15-20 min to complete. The collected data was analyzed for frequency of response after coding using the following themes 1) Access 2) Budget/ resources 3) Non sport specific 4) None qualified/ experienced 5) Other Results:. Twenty-six participants stated that they did not use a specialist as opposed to 16 who did. Further, 26 of 42 participants provided explanations (sometimes several) as to why they did not utilize a specialist. The two primary barriers identified by respondents were Accessibility (40%) and Cost/Budget (26%). Discussion/ Conclusion: Current coach and athlete practices rarely include the support of a Skill Acquisition Specialist despite many stating skilled performance is vital to success. Accessibility to specialists, and the potential cost, appear to be two main reasons for this limited use. This suggests that efforts are required to effectively inform coaches and athletes of the benefit of skill acquisition in addition to other well-established disciplines. References: Farrow, D., Baker, J., & MacMahon, C. (Eds.). (2008). Developing sport expertise: Researchers and coaches put theory to practice. London: Routledge: Taylor & Francis.

The effect of wearing of long leg compression garments on the kick accuracy of pre-elite Australian Football League players

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Introduction: The drop-punt kick is considered the most frequently used kick in the Australian Football League (AFL) because of its accuracy (Ball, 2009). Competent kicking execution is vital for accurate passing and goal scoring success. Training methods which promote skill acquisition are readily sought by coaches and skill acquisition specialists. Recent interest has developed in the effect of compression garments on movement (Cameron, Adams, & Maher, 2007), which may provide cutaneous stimulation thus increasing proprioceptive information. The purpose of this study was to determine the effect of wearing compression garments on the kick accuracy of pre-elite AFL players. Procedures: $N = 13$ (male) AFL players took part in this double-blinded, crossover, randomized and controlled laboratory study. Participants were filmed with a high speed camera performing 10 drop-punt kicks towards a target for three different garment conditions; fitted, loose and training shorts, with both their dominant and non-dominant leg. Results: Kicking accuracy when performing a drop punt kick between garment conditions on the dominant leg was significant ($p = 0.002$). The differences occurred between the fitted compression garment and loose compression garment ($p = 0.018$) and the fitted compression garment and training shorts ($p = 0.003$). Discussion/ Conclusion: Kicking accuracy decreased during a drop-punt kick when wearing fitted long compression garments on the dominant leg. This may be due to excessive information being presented to the kicker thus providing an 'information overload'. Further research is required to determine this, especially as many players wear long leg garments in cooler weather while training. References: Ball, K. (2008). Biomechanical considerations of distance kicking in Australian Rules Football. Sports Biomechanics, 7(1), 10-23. Cameron, M. L., Adams, R. D., & Maher, C. G. (2007). The effect of neoprene shorts on leg proprioception in Australian football players. Journal of Science and Medicine in Sport, 11(3), 345-352.

The relationship between static standing balance control and the Sensory Organization Test in Alzheimer's patients

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Alzheimer's disease (AD) is a major concern in today's society. In addition to the common problems with lack of memory and decline in cognitive functions, AD patients also suffer from serious balance related problems leading to complications in daily life. However, little is known regarding the relationships between static standing balance evaluations and popular balance evaluations like the Sensory Organization Test (SOT) in these patients, hindering proper assessment and development of rehabilitation protocols. Therefore, the purpose of this study was to determine if static standing postural testing is related to dynamic balance as evaluated with the SOT. Seven AD patients were recruited and compared with four age-matched healthy controls in eyes-open and eyes-closed conditions. Each subject stood still (looking straight ahead) on a force plate for two five-minute trials for each condition to acquire postural sway data. For dynamic balance, a Neurocom Balance Master system (Natus Medical Incorporated, CA) was used to perform the SOT. A 2×2 (group $\times$ condition) ANOVA was performed on the postural sway data with dependent variables being the root mean square (both anterior/posterior and medial/lateral; AP and ML), range (both AP and ML), sway path and the SOT composite score. In addition, Pearson correlations were performed to determine relationships between the static standing variables and dynamic balance (SOT composite score). No main or interaction effects were found, demonstrating the lack of differences between conditions and groups. However, significant correlations were found in the AD group for eyes-closed between the SOT test and AP ($p = 0.004$) and ML ($p = 0.04$) range. ML range also produced a significant ($p = 0.02$) correlation with the SOT test for AD eyes-open condition. No significant results were found for the control subjects, which may have been the result of the small sample size. Static standing balance seems to be related with dynamic balance for both eyes-open and eyes-closed conditions in AD patients. This means that with loss of cognitive impairment the control of posture is affected more holistically than we think. Moreover, this effect may not be removed in the presence of visual feedback for ML range. This may be due to a more active control required for lateral balance which is impaired in AD subjects. Moreover, visual feedback (specifically in this task) was richer in the AP direction.

Effect of exercise on implicit learning

Stevens, David J., University of Sydney; Anderson, David I., San Francisco State University; Arciuli, Joanne, University of Sydney; Williams, Mark, Liverpool John Moores University

When new information or skills are acquired without conscious awareness, they are said to be learned implicitly. While considerable research has shown that implicit learning is a robust phenomenon, little effort has been devoted to establishing what variables or contextual factors might suppress or enhance it. Here, we tested whether concurrent exercise would affect performance on a task that has yielded robust implicit learning in previous studies (Arciuli & Simpson, 2011; in press). During a familiarization phase, which lasted 8 min, participants were exposed to pictures that appeared sequentially, in a seemingly random fashion. Unbeknownst to the participants, the pictures were grouped into triplets that repeated in a predetermined sequence. In the surprise test phase, participants were informed about the triplets they had been exposed to during familiarization. They were then shown two sets of triplets and asked to guess which one they had seen during famil-

iarization. Twenty-four participants were randomly assigned to one of three groups: A control group that performed the familiarization phase while seated on an exercise bike, a group that performed familiarization while engaged in resistance free cycling (RFC), and a group that performed familiarization while cycling at 60% of max effort (EX). All groups performed the test phase 5 min after familiarization, while sitting still on the bicycle. The Control group correctly identified 72% (±14%) of triplets in the test phase, whereas the RFC and EX groups correctly identified 61% (±14%) and 55% (±13%), respectively. One-sample *t*-tests revealed that only the Control group showed implicit learning by demonstrating a level of performance that was significantly greater than chance (50%), $t(7) = 4.175$, $p < .05$. The RFC group just failed to demonstrate implicit learning, $p = .051$. These results show that concurrent exercise can suppress implicit learning. Work is underway to determine the mechanism by which such suppression occurs.

Prospective control of force output to 1/f-like isometric task goals

Studenka, Breanna E.; Newell, Karl M.; Pennsylvania State University

The prospective control of isometric force output was investigated via manipulation of the duration of visual information about future properties of target force waveforms that varied in predictability. Participants produced isometric force to target 1/*f*-like waveforms with different predictability (sine wave, brown, pink, and white noise). The time window of visual information about the upcoming waveform was varied (0, 83, 125, 250, and up to 2000 ms). For half of participants, past information about the target waveform and force production performance was provided. Availability of past information interacted with both duration of future information and target predictability. For almost all variables, the duration of future information was only significant when past information was not available. Furthermore, target waveform predictability influenced selective aspects of performance as duration of future information increased. For the more predictable target waveforms, a longer future window improved local aspects of force production (RMSE), whereas, for less predictable signals, a longer future window improved global aspects of force production (increased ApEn, decreased spectral slope, increased proportion of power from 4-12 Hz). In addition, the finding that availability of past information mediated the role of future information highlights the importance of past information on formulating predictions about the future. For predictable waveforms, past information diminished the advantage of more future information. For unpredictable waveforms, past information improved a participant's ability to approximate the spectral characteristics of the target. Even with no available future information, participants were able to incorporate higher frequencies into force production for the less-predictable waveforms, indicating that feedforward mechanisms need not be solely depended upon upcoming visual information. These results support the postulation that there are local and global mechanisms of prospective control that depend on the regularity of the task demands.

A comparative evaluation of ball-bouncing movements of children at a gymnastic dance club and an elementary school

Sugao, Hisayo, Hiroshima Shudo University

In physical education classes, children are instructed to use a variety of ball-bouncing movements. When the ball-bouncing movements are considered to have educational meaning, it is important to give children appropriate advice to improve their movements. In

order to give effective advice, it is necessary to evaluate and systematically distinguish the characteristics of ball-bouncing movements. The purpose of this study was to compare the quality of movements and performance of children with different levels of gymnastic dance experience undertaking a ball-bouncing task. Participants were children in a gymnastic dance club ($n = 17$) who had learned rhythmic gymnastics and dance and elementary school children ($n = 20$) who had not learned those skills. The task was to bounce a ball with 15 cm in diameter as many times as possible using the dominant hand for 20 s. Participants were videotaped to quantitatively analyze their ball-bouncing movements and count the number of bounces as an index of performance. An analysis of movement and performance revealed that the number of bounces increased as the movement quality improved in the gymnastic dance club children. However, movement quality was not directly related to the number of bounces in the elementary school children, and there were four types of relationships between movement and performance: type 1 with high quality of movement and a high level of performance, type 2 with low quality and low performance, type 3 with low quality and high performance, and type 4 with high quality and low performance. The results of this study suggest that it is important for PE teachers to evaluate not only the performance outcome but also the qualitative aspects of movement and instruct children to improve both the quality and performance aspects of movement in children in elementary schools.

Financial incentives influence the learning of a complex visuo-motor transformation

Sülzenbrück, Sandra; IfADo Dortmund; Sutter, Christine; RWTH Aachen University; Massen, Cristina; IfADo Dortmund

Optimal-control theory (Todorov, 2005) suggests that the goal of sensori-motor adaptation is the minimization of costs and maximization of benefits in terms of a re-optimization of movements in a novel environmental setting. Costs and benefits to adapt in a specific way can be related to biomechanical factors, but also to (the lack of) potential gratifications associated with a less or more accurate adjustment of movements. We examined whether modulating the benefits of adaptation by providing financial incentives rewarding end point accuracy affects learning and the internal representation of the complex visuo-motor transformation of a sliding lever. Two groups of 20 naïve participants had to reach different target positions with the tip of the load arm of a two-sided lever by changing the position of the effort arm of the lever with their right hand. An opaque screen prevented from direct vision of the lever and the tip of the load arm was represented by a cursor on a screen. After an elaborate practice phase with terminal visual feedback, the accuracy of the acquired internal representation of the novel transformation was assessed in subsequent test trials. While all participants in one group received a fixed amount of money for participating irrespective of their performance, participants in the other group received additional monetary reward for each movement executed during practice which satisfied a pre-defined level of end point accuracy. The monetary reward received linearly increased with decreasing Euclidean distance between the end point of movement and the target position. Our results show that financial incentives improved performance in terms of shortened movement times throughout practice and in open-loop tests. Also, monetary rewards were associated with higher end point accuracy during early practice, but hardly influenced accuracy during late practice and test trials. The implications of these findings for optimal-control theory will be discussed.

Fractionated reaction time in load carrying gait initiation

Sun, Ruopeng; Shea, John; Indiana University

The fractionated reaction time paradigm partitions reaction time (RT) into the premotor time (the interval from stimulus to the EMG onset, PRT) which represents the central processing component, and motor time (from EMG onset to the beginning of movement, MOT) which represents the peripheral musculature component. In this study, we adapted this paradigm to gait initiation. Subjects were required to stand on a TEKSCAN HR-MAT and maintain their balance at the beginning, and begin their gait after hearing the sound stimulus generated by LABVIEW. Bilateral surface EMG recordings were made of tibialis anterior (TA) and medial gastrocnemius (GA) activity throughout gait initiation. The first EMG onset measurement represents the EMG onset. Postural sway center of pressure (COP) was calculated and the beginning of movement was determined by the time when COP sway path reached a predetermined threshold value. Subjects performed gait initiation for 10 trails in each of 6 conditions: 10 lbs of hand load on the swing side, stance side and in front of the body; a piece of cardboard cut to the same dimensions as the 10 lb weight on the swing side, stance side and in front of the body. Preliminary data showed that the PRT of load and no load conditions were similar (254 ms vs. 251 ms), while the average MOT in load carrying conditions (14 ms) was smaller than MOT in no load conditions (27 ms). This result agrees with the Dick et al. (1986) finding that the onset of EMG activity in each of the postural muscles does not depend on load. Also the shortened MOT in the load condition suggests that the TA muscle adjust itself prior to the initiation to match the added weight.

Effects of emotional stimuli and psychological pressure on spinal Hoffmann reflex amplitude

Tanaka, Yoshifumi; Tanaka, Atsushi; Tezukayama University; Tanaka, Yufu M.; Kinki University

Coping with emotional changes is an important issue in sports. We examined the influence of emotional stimuli and psychological pressure on the spinal reflex response and muscular activity. In Experiment 1, healthy male participants ($n = 9$) viewed 36 pictures (12 neutral, 12 pleasant, and 12 unpleasant) taken from the International Affective Picture System. The Hoffmann reflex was obtained from the right soleus muscle by stimulating the tibial nerve. EMGs of the right soleus and tibialis anterior muscles were recorded. Each picture was presented for 13 s and 10 stimulations at 1 Hz were administrated. Results showed that the H-reflex gain (ratio of the H-reflex amplitude to background EMG of the soleus muscle) for pleasant pictures was significantly larger than for neutral pictures ($p < .01$) when participants performed a sustained submaximal isometric contraction of the soleus muscle. No significant change in the EMG amplitudes of either muscle was shown between the three picture conditions. In Experiment 2, healthy male participants ($n = 7$) performed a balancing task by standing on a balance board with one foot. In each trial, participants were requested to stabilize their posture on the board for 20 s. After four acquisition trials, they performed one non-pressure trial and one pressure trial involving a performance-contingent cash reward, or punishment. Eighteen stimulations at 1 Hz were administrated in each trail. The results showed that the H-reflex amplitude in the pressure trial was significantly smaller than in the non-pressure trial ($p < .05$). There were no significant differences in EMG amplitude, or co-contractions in any of the muscles in the non-pressure, or pressure trials. The results of these two experiments indicate that psychological changes when performing motor tasks, such as enhanced positive emotions and performance anxiety can modify the spinal reflex

function. Furthermore, it is suggested that the mechanisms of this modification are different between positive emotions (increase) and performance anxiety (decrease).

Effect of explicit and implicit perceptual training on anticipating pitch-type by novice baseball players

Tanaka, Yufu M., Kinki University; Sekiya, Hiroshi, Hiroshima University; Tanaka, Yoshifumi, Tezukayama University

Effect of explicit and implicit perceptual training on pitch-type anticipation in baseball batters was investigated after presenting information on preceding pith-type probabilities. Novice baseball players ($n = 30$) were randomly assigned to an explicit or implicit instruction group, or a control group. They were administered 30 test trials followed by 60 perceptual training trials on the first day, 30 test trials followed by 120 perceptual training trials on the second day and just 30 test trials on the third day. Only the explicit instruction group was presented with anticipatory cues, the implicit instruction group was instructed to react intuitively, whereas the control group performed only the test trials. During the test trials, information on the probability of a fast- or curved-ball was presented as a percentage: either 50% (chance level), 60%, or 80 %, for 1 s at the start of a movie depicting the pitcher's motion. Results indicated that the awareness of anticipatory cues in the explicit instruction group was higher than in the implicit instruction and control groups, indicating that the instruction to react intuitively inhibited the awareness of anticipatory cues. Awareness of information in the 80% condition was higher than in the 60% condition, indicating that the experimental manipulation of information was effective. In addition, in both explicit and implicit instruction groups, anticipatory skills improved with or without information. Anticipatory skills in the explicit instruction group improved with 60 perceptual training trials, whereas in the implicit instruction group they improved with 180 trials, indicative of anticipatory skill improvement in both groups, regardless of the level of cue awareness or preceding information. It is concluded that explicit instructions result in faster learning during the perceptual training of novice baseball players.

Differences in the viscoelastic properties of the Achilles tendon between adults and children

Theis, Nicola; Korff, Thomas; Mohagheghi, Amir A.; Brunel University

Motor development during childhood is influenced by many factors including the maturation of the nervous and musculoskeletal systems. Within this context, a change in the elastic properties of the tendon plays an important role, as the tendon stores and releases potential elastic energy and transfers muscular forces to the skeleton. Previous research has demonstrated that tendons become stiffer as children grow. Such changes have potential implications for the fast transfer of muscular forces to the skeleton and therefore motor performance. As the tendon is viscoelastic, its stiffness increases with increasing strain rate. Here, we asked whether the strain rate-related increase in tendon stiffness would be different between adults and children. Fifteen adults (20-28 years) and 15 children (age 9.1 ± 2 years) performed a series of passive ankle rotations of different angular velocities (1, 10, 30 deg/s). Achilles tendon force and elongation were obtained from a combination of motion analysis, dynamometry, and ultrasonography. Tendon force and strain rate were standardized across the two groups. Achilles tendon stiffness was calculated as the slope of the force-elongation curve, and was compared at tendon strain rates of 1, 4, and 8 mm/s between adults and children. For both children and adults, tendon stiffness increased

linearly with increasing strain rate (R^2 of 0.98 and 0.95, respectively). However, the slope describing this relationship was significantly steeper in adults than children. As a result, the difference in tendon stiffness between children and adults increased with increasing strain rate. These results indicate that the tendon's viscoelastic properties differ between children and adults alongside growth-related changes in tendon stiffness. This difference in material properties may be the result of altered collagen types and arrangements within the tendon. The results are likely to influence force production and movement skill, and should be considered when observing or interpreting age-related changes in muscular force production or motor performance.

Long-term tai chi participation benefits fine motor skill function of Parkinson's disease patients

Van Gemmert, Arend W.; Li, Li; Prejean, Patti; Pan, Zhujun; Hondzinski, Jan M.; Louisiana State University

Research has shown that exercise successfully improves gross motor function related to gait and mobility in Parkinson's disease (PD) patients. Use of tai chi (TC) exercise has shown short-term benefits in gross motor function. We have presented long-term benefits of TC training on gross motor functions; however, TC training benefits of fine motor skills, also degraded in PD, are unknown. The purpose of the present study was to determine if benefits of TC exercise exist for fine motor skills in individuals with PD. Nine people diagnosed with idiopathic PD with disease severity ranging from I to III (Hoehn & Yahr) were evaluated before and after long-term (6+ months) practice in a modified TC exercise program. Fine motor skill function was assessed with primary measures involved in matching the writing size of 20-mm cursive connected *l*'s: stroke size (SS); movement time (MT); peak velocity (PV); and normalized jerk (NJ). Secondary measures included the Unified Parkinson's Disease Rating Scale motor examination (UPDRS-III), the timed-up-and-go (TUG), the dynamic gait index (DGI), the 6-min walk (6MW), knee flexion/extension strength (FLEX/EXT), and quiet standing balance with eyes open (center of pressure area (CoPA) and velocity (CoPV)). Pre and post training measures were compared using paired *t* tests ($\alpha < 0.05$). Patients participated in 1-2 training sessions/week. Patients failing to match the 20-mm size before training still failed after training, but MT improved marginally and PV improved significantly. Values for the 6MW, FLEX and EXT also improved significantly. A closer review of the data showed of the 9 patients 7 became faster (less MT; greater PV) and 8 moved with more smoothness (smaller NJ) on the size matching task. Five patients improved on the UPDRS-III and CoPV, 6 on the CoPA, 7 on the TUG, EXT, and FLEX, and 8 on the 6MW. We determined that fine motor function deterioration as result of PD may be reversed along with gross motor functions as result of participating in a modified TC program, thus reducing functional dependency in those with PD.

An update on prosthetics training in occupational therapy programs

Wallace, Stephen; Gorelic, Mark; Anderson, David; San Francisco State University

Researchers and clinicians have expressed concerns that occupational therapy graduates are insufficiently prepared to evaluate, treat, and train patients in the use of upper-limb prostheses. This problem is particularly pressing given that over 500,000 individuals living in the US have an upper-extremity amputation and the numbers of amputations is increasing dramatically due to vascular disease and injuries sustained by military personnel (Zeigler-Graham et al., 2008). The current study was designed to update a survey conducted by

Atkins (1992) on the training experiences OT students receive in prosthetics during their baccalaureate and post-baccalaureate degrees. Based on the original survey, we developed a 14-question online questionnaire that was made available to the directors of 167 OT programs in the US and Canada. Fifty-nine surveys were completed for a response rate of 35% (identical to Atkins's rate of return). Overall, the results indicated that in the 20 years since the original survey little has changed in the importance OT faculty assign to providing training in prosthetics and orthotics or in the training experiences OT students receive. Notably, less that 5% of the total OT curriculum is devoted to training in prosthetics, which equates to approximately 3-5 hours of training throughout the entire degree. For the majority of programs (60%) the content was embedded within related classes. Only 20% of programs had a required class in prosthetics/orthotics. Despite the lack of training, 79% of program directors thought that training in prosthetics/orthotics was important or very important, 43% wanted access to additional training material online, and 50% wanted access to a prosthetic simulator. Lack of time and overcrowding in the curriculum were cited as the greatest barriers to providing more training to students. We elaborate on these findings, discuss their implications for OT graduates and provide specific recommendations about how to overcome the barriers and enhance training in prosthetics/orthotics utilizing motor control and motor learning concepts.

Verbal cues in motor learning: focus on the component and on the interaction between components

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The purpose of this study was to investigate the effects of verbal cues focusing on the component and on the interaction between components in learning a continuous skill. Participants were 20 non-swimmers of both genders, between the ages of 12 and 14 years, randomly distributed in three experimental groups: with component cues (CC), with interaction between components cues (ICC) and without cues (NC). The task to be learned was to swim 8 m front crawl stroke. The experiment was carried out in three phases: acquisition, retention and transfer. Time to execute the task and the movement pattern—Langendorfer's checklist scores—were analyzed considering the images captured by a camera (60 fps) on acquisition, retention and transfer phases. ICC was the only one who improved the movement pattern and decreased the time to accomplish the task. The results showed that, considering a learner at the initial learning stage, only the verbal cue focusing attention on the interaction between components—specifically, on the time to breath in relation to the arm stroke, was effective for the acquisition of the front crawl. These findings are in line with the notion that cue effectiveness is greater when associated to the nature of the task.

Emotional valence and motor performance of Bharathanatyam hand gestures

Williams, Camille; Ganeshamoorthy, Maurry; Carnahan, Heather; University of Toronto

Movements that communicate are universal. Specific movements can be made to explicitly express emotions (e.g., clenched fists in anger, jumping for joy, or telling a story through dance). Bharathanatyam (Bhara) dance is an ancient art form from India, based in expression of emotions and elaborate hand gestures. Of interest was how the learning and short-term remembering of these hand gestures could be augmented by emotional content and verbal labels. 16 participants with no experience in Bhara dance participated. 15 words associated with the dance hand gestures were chosen from the Affective Norm for English word list.

Participants watched an instructional video, which showed 5 positive, 5 negative and 5 neutral gestures, each presented twice - with or without the associated verbal word labels. Participants were videotaped as they repeated each gesture after its presentation. An expert Bhara dancer viewed each video and scored participants' using a modified version of the limb praxis error system (Roy, 1985). Our scoring system contained 8 error categories and a correct category. Differences due to Meaning were analyzed using the Wilcoxon signed-rank test, while Valence was analyzed using Friedman's ANOVA. Results showed that the presence of verbal labels did not affect how many errors were generated when participants made the hand gestures from memory. And for both the labeled and unlabeled gestures, those with either highly positive or highly negative valence were remembered and reproduced with less error than those gestures associated with neutral valence for several of the error measures. These findings show that the retrieval and formation of the gestural representations was not augmented by a verbal label, and support the body of literature showing the relevance of emotional content on motor control and learning.

Type of motor response can modulate subliminal motor priming

Wou, Lauren A., University of British Columbia; Cressman, Erin K., University of Ottawa; Chua, Romeo, University of British Columbia

In recent work (Cressman et al., 2007), we have suggested that the type of motor response required may modulate the impact of an invisible prime stimulus on response selection processes. To examine this proposal, we analyzed performance when participants made either a speeded key-press or a rapid aiming movement in response to visual stimuli displayed in a prime-mask sequence. Participants (10) were presented with a pair of visual targets (1 on each side of fixation), which consisted of a circular and square ring. Participants were instructed to respond according to the side of the circular ring by making either a left or right key-press (discrete task) or a rapid aiming arm (flex/ext) movement (continuous movement task) in the direction of the target. Unbeknownst to participants, targets also served as visual masks and were preceded by a briefly presented pair of prime stimuli, consisting of a filled square and circle (Schmidt & Schmidt, 2010). The masked circle prime appeared either in the same (congruent) or opposite (incongruent) location to the circular target. Masks could also be preceded by neutrally shaped primes presented at both locations. A perceptual task in which participants were informed of and asked to identify the location of the circle prime showed that the primes were masked from participants' conscious awareness (accuracy < 51%). Nevertheless, when the location of the masked circle prime was congruent with the circular target mask, key-press RT and aiming RTs were faster than when the prime-target locations were incongruent (key-press: 347 vs. 409 ms; aiming: 414 vs. 456 ms). For the key-press task, the RT benefit (~24 ms) of the congruent prime relative to neutral was smaller compared to the RT cost of the incongruent prime (~38 ms). For the aiming task, the RT benefit (~23 ms) and cost (~19 ms) relative to neutral were within a similar range. The results show that subliminal visual shapes can influence the initiation of motor responses and the type of motor response may influence the threshold required for prime-triggered motor initiation.

Examining the phenomenon of "transfer of training" in video games: Assessing the ability of Nintendo Wii bowling practice to promote actual bowling performance

Wright, Tim; Wershing, Ben; Bloom, Jared; Hunker, Ryan; Bonnette, Scott; Raudenbush, Bryan, Wheeling Jesuit University

With the introduction of the Nintendo Wii video gaming system as a simulator of real-life sporting events, many have questioned its ability to transfer skills learned on the Wii to real-life sports performance. The present study hypothesized that the Wii bowling training sessions would improve real-life bowling performance. Participants were taken to a bowling alley to establish a baseline of skill. Following the baseline assessment, half of the participants then practiced bowling with the Wii, three times a week for two weeks. The other half of the participants (the control group) abstained from bowling for two weeks. Both participant groups then returned to the bowling alley and their actual bowling performance was re-assessed. This study found no significant transfer of training effect for the Wii bowling gaming condition. More importantly, a negative correlation was found between the Wii bowling training session performance and the post-Wii practice real-life bowling re-assessment session. This indicates that the Wii training was actually detrimental to actual bowling performance, suggesting that Wii bowling and actual bowling require a completely different set of skills, and that practice on the gaming system will not transfer to real-life performance.

Goal variation within a self-controlled learning paradigm: Does it influence practice strategy and learning?

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The enhanced learning effects of self-controlled learning environments have been attributed to self-regulatory processes (Wu & Magill, 2011). According to Baumeister and Vohs (2004), self-regulatory processes are comprised of an interaction between goal setting, steering processes and strategies, and self-evaluation. The purpose of this study was to investigate the interactive process of self-regulation within a self-controlled learning environment. More specifically, how does goal specificity influence practice strategies and learning when learners are provided control over the amount of practice? It was hypothesized that more specific goals would elicit a greater number of practice trials and a better learning outcome than goals that were less specific. Undergraduate participants were asked to learn the sequence and relative timing pattern of a four-keystroke pattern. Participants were provided control over the number of practice trials during the acquisition phase. Each participant was randomly assigned to one of two conditions, a zero-error goal condition, in which their goal was to achieve performance times with no error, or an 80-ms error goal condition, in which their goal was to try and achieve performances that were within ±80 ms of each goal time. Results of the study revealed that participants in the zero-error goal condition allocated significantly more practice trials during acquisition than participants who were given an 80-ms error range as their goal. Although there were differences in the number of trials practiced, learning differences were not observed. Consistent with previous studies in self-controlled learning (Chiviacowsky & Wulf, 2002; Wu & Magill, 2011), qualitative analyses revealed that participants stopped practicing based on evaluation of their performance. The results of the study demonstrate the effect of goal specificity on learning strategies during acquisition. In addition, the results of the study provide support for the interactive process of self-regulation within a self-controlled learning paradigm.

Enhanced expectancies improve movement efficiency in runners

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

Recent studies have demonstrated that enhancing performers' expectancies can improve motor performance. In the present study, we examined whether providing experienced runners with positive feedback regarding their movement efficiency would increase running efficiency. Two groups of experienced runners ran on a treadmill at 75% of their VO_2max. One group (enhanced expectancy, or EE, group) was provided with fabricated feedback about the efficiency of their running style every 2 min. A control group was not given feedback. Oxygen consumption decreased in the EE group across measurement times (every 2 min for 10 min), but remained the same in the control group. In addition, performance perceptions changed only in EE group participants indicating a perception of greater ease of running and reduced fatigue when assessed post-running as compared to pre-running. Finally, positive affect increased from a pre- to a post-test in the EE group, in contrast to the control group. The findings show that enhanced expectancies can have a positive effect on movement efficiency in experienced performers. They add to the accumulating evidence for the social-cognitive-affective-motor nature of motor performance.

The individual differences of initial performance has more influence to the amount of learning than the learning strategy in three-ball juggling

Yamamoto, Kota; Tsutsui, Seijiro; Aichi University of Education

This study examined the relationship between learning strategies and the individual differences of initial performance in the early stage of learning a three-ball cascade juggling task. The participants were 36 college students who had no experience with this task. They were divided into three learning strategy groups; observational learning, physical restriction method, and control group. The observational learning group observed both an expert model and themselves before each set. The physical restriction method group performed trials sitting on a chair in order to restrict forward movement because participants usually throw forward in the early stages of learning. The control group had no observation or restriction. They were asked to continue juggling as many times as possible. Performance was scored using the maximum number of consecutive balls caught in each set. An acquisition session consisted of eight 15-min sets (120 min), and the retention test 1 week later session consisted of five trials. There was no difference in learning strategy between the acquisition session and retention test. However, a strong correlation was found between the score of the first (0 - 15 min) and eighth (105 - 120 min) sets, implying that the first set score can predict the eighth set score in learning a novel motor skill, i.e., the initial performance predicts the amount of learning than learning strategies in the early stage of learning of motor coordination with multiple degrees of freedom, such as a three-ball juggling task.

Sleep and nap enhance developmental motor learning

Yan, Jin H. H., Shanghai University of Sport

Motor skill acquisition occurs on-line (practicing) and off-line (asleep or awake). Studies of adults' off-line learning have contributed to the understanding of the neural processes of on- and off-line motor learning and memory consolidation. A challenge is to use an appropriate paradigm to describe and explain the dynamics of children's off-line learning in developmental time. This challenge motivated the current study. Because children usually develop cognitive and motor skills quickly and considerably as a result of the growing experiences and maturation, developmental questions remain about whether children of different ages equally benefit from sleeping or napping in motor learning. The scope of

off-line learning in children is also unclear. This study therefore examines the contributions of sleeping and napping to developmental procedural learning. Children explicitly practiced a finger movement sequence with keyboards. After an equal 12-hr interval in three distinct states (nighttime sleeping, daytime napping, and waking), they performed the same sequence in the retention test and a novel sequence in the transfer test. Changes in movement time (MT) and sequence accuracy (SA) were evaluated between age groups (6, 8, 10 years) during practice, before retrieval trials and across treatments. On-line learning reduced MT for all children. Sleeping and napping improved movement speed off-line, especially for younger children. There were no significant off-line improvements in motor accuracy. Age was shown to have no significant effects on off-line motor learning in children due to the passage of time. Developmental neural plasticity or sleeping quality can contribute to off-line learning or memory consolidation. Likewise, children improved their fingers movement speed as a result of on-line learning or practice while no comparable changes were evident for motor accuracy. Overall, this work provides evidence for children's on- and off-line motor learning and it also provides a potential means for enhancing cognitive and motor skills of children.

Bilateral transfer in force control is task specific

Yao, WanXiang; Herring, Curtis; Wu, Yi-Chiann; Yan, Alice F.; University of Wisconsin at Milwaukee

In previous studies, when a task consisting of both sequential timing and force estimation components was learned by one hand, the results showed that only the timing component was significantly transferred to the non-trained limb. The purpose of the study was to further test the efficacy of bilateral transfer of force control with a task consisting of force estimation only. Eight right-handed college students participated in this study. They were asked to learn a sequential force estimation skill: exerting four small isometric forces by abducting their right (dominant) index finger against a force transducer. The target force was 30% of each subject's maximum voluntary contraction. There was no goal movement time, but the four force exertions had to be completed within 2 seconds. The subjects performed 60 practice trials with their dominant hand only. Following each trial the subjects were provided with visual feedback concerning their actual force production. Before the practice, an experimenter gave a demonstration of the task, which was followed with 20 no-feedback test trials (pretest) with both the dominant and non-dominant hand. Five minutes after the practice, the subjects performed a posttest for each hand which also consisted of 20 no-feedback test trials. The absolute errors (AE) of force estimation for the pretest and posttest was calculated and analyzed with 2 (Hand: right vs. left) × 2 (Test: Pre vs. Post) ANOVA with repeated measures on both factors. The results show a significant main effect on Test, $F(1, 7) = 9.43$, $p < .05$, but no significant effects for Hand and Interactions between the two factors, $F(1, 7) = 0.41$, $p > .50$, and $F(1, 7) = 2.19$, $p > .10$, respectively. The results of the current study demonstrate that the skill learned by the dominant hand was significantly transferred to the non dominant hand when the task consisted of only the force component. This finding along with previous findings in the area tentatively suggests that neuromechanisms underlying learning force control are different from learning timing control.

Timing the volleyball jump serve

Yen, Ya Ting; Liu, Yeou-Teh; National Taiwan Normal University

Volleyball jump serve is a skilled technique which needs precise timing to make a successful serve. Most of the literatures emphasized on improving the quality of serve, therefore this study was focus on explore the key elements in the success/ failure jump serves from a movement timing perspective. The movement was captured by two high-speed cameras (200 fps), and was digitized. A successful trial was defined to be served clear the net and landed into a effective zone (4 m × 3 m). Ten successful serves for each participant (and 10 or less failure trials) were collected and analyzed for each type of serves. Exp1 examined the differences between different types of standing serves and 2 different skill levels each with 6 players. Exp2 examined the jump serves of the elite players and compared the corresponding data from Exp1. The conclusions were as follow: 1. Under the constraint of effective zone, there were no significant difference between skill level and serve type on the movement timing and its stability. 2. The ball tossing height and the jump movement reflected the relationship between ball strike window and the task difficulty showing jump serve was a more difficult skill. Arm swing was the common element of different serve types. To ensure a successful serve, the timing before the arm swing must be well adjusted in order to maintain the stability of arm swing. The main timing adjustment in standing serves was the backswing of the forearm, and for jump serves, individual analyses on the timing strategies revealed the approach phase and the height of jump were the 2 main timing adjustment methods. 3. The lower relative height at ball strike and the small angle of ball flight were the ultimate causes for failure serves. Many factors prior to the ball strike could contribute to these final causes. Individual players often had their specific timing patterns and cause of failure serves. We suggest to analyze individual movement characteristics to better understand the main reasons for failure serves and design individual training program to improve the jump serve.

Tactile feedback is necessary for synchronization in repetitive circle drawing

Zelaznik, Howard N., Purdue University; Studenka, Breanna E., Pennsylvannia State University

Recent work by Studenka and Zelaznik (2011a,b) extended the event-emergent timing model of Ivry, Spencer and Zelaznik. Studenka observed that if a circle drawing timing task does not have a salient event along the trajectory, that participants do not synchronize to the metronome. Furthermore, she the execution of phase corrections to a single metronome perturbation is dependent upon salient tactile feedback at the timing target. We take these results to support the notion that another important distinction between event and emergent timing is the discreteness of feedback. In the present study we further examine this matter in repetitive circle drawing in which participants attempt to synchronize to a metronome that either is constant, random, or a repeating random sequence (the same sequence is repeated across trials). Furthermore, the event structure is manipulated through the availability of discrete tactile feedback at the timing target (Velcro) or not (No Velcro). There were 48 participants. Eight performed in each of six between group conditions (3 levels of metronome by 2 levels of tactile feedback). Results were clear cut. There was a significant reduction in the RMSE in synchronization for the two Velcro conditions compared to the Constant metronome ($p < .05$). However, there was no difference between the repeating versus random metronome. Thus, we provide further and new support for the work of Studenka concerning the role of salient events in timing in circle drawing, but did not provide evidence that subjects can implicitly learn the metronome sequence.

EMG as a tool to assess foot reaction time asymmetries

Zhang, Jian; Li, Kai; Wang, Donghai; Liu, Ying; Shanghai University of Sport; Li, Yuhua, University of Memphis

Motor lateralization has been extensively studied with much focus on hand movement responses. Although foot or leg laterality is particularly relevant in some sport performances, little research has been conducted in this regard. To address this omission, the present investigation was designed to determine if foot movement asymmetries existed in a group of college athletes. Twenty-one college student athletes (M = 19.86 years of age; SD = 1.01) were tested on foot movement choice reaction time (CRT) to a visual stimulus emanating from one of four different directions (i.e., forward and backward on both dominant and non-dominant foot). Surface electromyography (EMG) data on the four lower limb muscles (i.e., tibialis anterior and gastrocnemius of both legs) were collected during the test trials. Premotor time (PMT - central processing) was significantly different in both the lateral axis, $F(1, 1983) = 63.13$, $p = 0.001$; and sagittal axis, $F(1, 1983) = 44.27$, $p = 0.007$, suggesting the dominant foot reacted faster than the non-dominant one, and the backward was faster than the forward. In contrast, motor time (MT - peripheral involvement) was slower on the backward for the dominant foot. Moreover, the non-dominant foot in the forward direction had more muscle groups activated than for the other directions, and reacted slower than the other directions on PMT and CRT. The EMG data provide strong evidence suggesting that motor asymmetries for the lower limbs are not only influenced by central processing but also by peripheral motor control.

Expert release control in response to changing spatial properties of a remote target

Zhu, Qin, University of Wyoming; Lu, Jidong, Shanghai University of Finance and Economics

Previous research (Zhu et al., 2009) showed that people learned to release ball faster without changing angle much to achieve a maximum throwing distance. It is unknown whether this release control will remain in long distance aimed overarm throwing. The current study is aimed to examine the release control in response to the changing distance and height of a remote target. Six expert throwers (3 male baseball players and 3 female softball players) were asked to throw a tennis ball at a target board that varied in distance (5 m, 10 m or 15 m) and height (Eye Height, Below and Above EH). Five throws were made by each thrower in each distance-height configuration, and a 2-D motion capture system was used to capture each throw for analysis of release control. The results showed that release velocities increased with throwing distances regardless of target height ($F_{2,8} = 286.54$, $p < 0.001$), and males threw faster than females with more increased release velocities for longer distances ($F_{2,8} = 28.21$, $p < 0.001$). Although there was a trend for release angle to converge with increasing distance and height ($F_{4,16} = 13.26$, $p < 0.001$), females adopted greater release angles as target moved farther and up ($F_{2,4} = 63.71$ and 23.24, $p < 0.01$), while males only released the ball higher for acquiring higher target regardless of throwing distance ($F_{2,4} = 32.8$, $p < 0.01$). The regression analysis revealed that release velocity co-varied with release angle only for females ($r^2 = 0.18$, $p < 0.001$), indicating that female throwers may have to increase release angle to compensate for lack of speed generated during release for acquiring a remote target.

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Developmental Perspectives: Motor Control/Coordination/Rehabilitation*

Physical activity and healthy lifestyle for Egyptian adolescents with intellectual disabilities: Aquatics exercise vs. land-based exercise

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Introduction: Individuals with intellectual disabilities (ID) are in need of effective physical fitness programs. There is a critical need to better understand how different kinds of physical activity programs may shape cardiopulmonary function (CF) with ID subjects. Purpose: Determine and compare aquatics program vs. land program on CF responses in ID subjects following 16 weeks, 5 times per week, 30-45 min/unit. Both programs performed with the same duration, intensity, and frequency for two groups. Methods: After the approval of the institutional ethics committee, thirty male adolescent with mild ID divided in two groups: group (A), aquatic exercise $n = 15$; age ($15.2 \pm .94$ years) compared with matched mild ID group (L) land exercise (football) $n = 15$; age ($15.1 \pm .63$ years). All subjects group matched for age, ID level, and CF, and underwent lung volume parameters spirometrically before and after training programs. Forced vital capacity FVC, expiratory and inspiratory volumes and capacity (ERV, IRV, IC), forced expiratory volume in 1 s (FEV1) and the ratio of FEV1 to FVC, max voluntary ventilation (MVV), (PEF, TLC) and electrocardiography (ECG) were measured. Results: All analyses were performed by SPSS; mean ± *SD*, *t* test estimated differences between groups and percent improvement. Significant ($p < 0.05$) improvements in CF were demonstrated for both groups. The aquatics group showed significant differences and greater improvement in lung function compared with group L. The FVC, ERV, IRV, IC increased by group A: 38.08%, 17, 70.5, and 61.5% versus group L: 5.1, 7.3, 7, 6, 8%. The FEV1, FEV1/FVC, MVV, PEF, and TLC increased by group A:61.5, 4.1, 2.8, 31, 37.6%, respectively) compared with group L:11.6, 8.9, 2.3, 12.4, 8.9%, respectively). Conclusions: Aquatics exercise is an effective and suitable sport to enhance CF responses for subjects with ID because the unique environment, water, and the buoyancy of water decrease the influence of gravity, which allows the subjects to move with more freedom than on land. Further research is needed to establish current physical activity levels of subjects with ID in Egypt and other developing countries.

Role of intention in simulated actions: A developmental view

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*The abstracts are alphabetically arranged by the first author's surname within each of the three sections—Motor Learning and Control, Developmental Perspectives: Motor Control/Coordination/Rehabilitation, and Sport and Exercise Psychology.

Previous work with adults provides evidence that "intention" used in processing simulated actions is similar to that used in planning and processing overt movements. With the present study, we addressed the question from a developmental (age-related) perspective by comparing young adults and children. Our initial thoughts were that whereas intention is associated with motivation and commitment to act, age-related differences could impact planning. That is, children could possibly be more motivated to attend to the task goal with knowledge that execution follows. We examined participant's ability to use motor imagery to estimate distance reachability using a GO / NOGO paradigm. That is, imagery only (IO) and imagery with actual execution (IE). The sample consisted of 15 children ages 7-10 years ($M = 8.82$) and 15 young adults, 18-23 years ($M = 19.8$). After measuring actual maximum reach, used for target presentation and comparison with imagery responses, seven imagery targets were randomly presented across peripersonal (within reach) and extrapersonal (beyond reach) space. Conditions were given in counterbalanced order with two trials at each of the seven sites per condition. ANOVA results indicated no difference in overall accuracy by condition within groups ($p > .05$), and as expected adults were more accurate, $p < .001$. These findings support an increasing body of evidence suggesting that the neurocognitive processes (in this case, intention) driving motor imagery and overt actions are similar, and functioning by age 7.

Do motor skill interventions work in the long term?

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Purpose: A 10-month Australian preschool intervention (2006/07) with a movement skill focus found intervention children improved their movement skills significantly more than controls (relative improvement of 13%). The current study sought to determine whether intervention children were still more skill proficient than controls three years later. Methods: Children were assessed at 4 years old (Pre), 5 years (Post) and 8 years (Follow-up) for locomotor and object control proficiency using the Test Gross Motor Development-2. Two multi-level object control and locomotor regression models were fitted with variables time, intervention (yes/no) and a time × intervention interaction. Both models added child gender and retained if significant, in which case interactions of gender with other variables were modeled and retained. SPSS (Version 17.0) was used. Results: Follow-up rate was 29% (163/559). Of the 137 students used in this analysis, 53% were female ($n = 73$) and 54% ($n = 74$) were intervention children. Intervention girls maintained their object control skill advantage in comparison to controls ($p = .002$), but intervention boys did not ($p = .591$). There were no longer intervention/control differences in locomotor skill ($p = .801$). Conclusion: Boys who have not gained object control skills prior to school may be likely to develop these skills through environmental opportunities. On the other hand, control girls in our study did not develop their object control skills to the point where they caught up to the intervention girls. This study suggests that if girls were provided with the same opportunities for instruction, feedback, practice, and encouragement, the differences in object control skill proficiency between girls and boys could be reduced. Movement skill interventions aimed at normally developing populations should therefore target girls more intensively. Also, object control skills could be targeted in preference to locomotor skills as

accelerating locomotor skills through the intervention did not result in increased locomotor ability three years later.

Motor performance and personality trait: A correlational study

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It is known that personality trait is linked with an individual's life style of individuals, as well as their physical activity levels. However, we do not know if skillfulness, which may reflect the individual's overall motor competency, can also potentially be linked to personality traits. In this study we aimed to identify relationships between motor performance (manual dexterity, object and balance control skills) and personality trait (extraversion and introversion). Fifty-eight children, between 7 and 10 years old (n = 58; 26 boys; mean age = 8.83 years, SD = 1.10; 32 girls; mean age = 8.62 years, SD = 1.09), participated in this study. Personality traits were assessed by the "Personality Traits Scale for Children," and motor performance was assessed by the tasks of placing pegs, threading lace, drawing trail (manual dexterity), catching with two hands, throwing beanbag onto mat (object control) and one-board balance, walking heel-to-toe forward and hopping on mats (balance). The Spearman correlation showed no correlations between the motor performance scores and personality trait ($p > 0.05$), indicating that extraversion trait may not influence motor performance in manual dexterity, object control and balance skills, and total motor standard score. According to some studies, extraversion trait is related to subject's physical activity. Thus, the next step in this study will be including physical activity in a regression model. In sum, in this study, extraversion/introversion trait did not influence children's motor performance in manual dexterity, object control and balance skills.

Video games as therapy: The impact of a novel neurofeedback intervention for children with fetal alcohol spectrum disorders (FASD)

Bertram, Chris P., University of the Fraser Valley; Mandryk, Regan; University of Saskatchewan; Keiver, Kathy, University of the Fraser Valley; Pritchard Orr, Alison, University of the Fraser Valley; Khaleel, Bassam, University of the Fraser Valley; Dunne, Shane, Dunne & Associates Technology Consulting, Inc.; Reynolds, James N., Queens University; Gaetz, Michael, University of the Fraser Valley

The spectrum of adverse effects resulting from prenatal alcohol exposure, which includes several diagnostic subgroups, is collectively termed Fetal Alcohol Spectrum Disorders (FASD). The current study sought to evaluate the effectiveness of an intervention program based on developing the strengths of the children to the fullest capacity. Studies indicate that children with FASD demonstrate two such strengths: a) within the domain of motor function and b) in their aptitude for working with computer-based technologies. Five children (age 6-16) with a confirmed diagnosis of FASD took part in a 12-week program (24 total sessions) designed to capitalize on the demonstrated aptitude with computer-based technologies. More specifically, we incorporated a novel neurofeedback training system in which the children experienced visual disruptions (e.g., clouds or spiders) while they played video games. The visual disruptions were driven by real-time EEG recorded at the central midline (Cz) electrode. Cz was selected to detect a ratio of theta (4-7 Hz) and sensorimotor rhythm (SMR - 13-15 Hz) activity both linked to a state of calm focused attention in children. A number of differences were evident for the children with FASD at

time 1 compared to a published normative data base including significantly elevated theta, reduced SMR, and large amounts of spindling beta activity (20-26 Hz range). Preliminary results indicate that small shifts in SMR were observed following the intervention with no significant shift in theta activity. We interpret these data as a promising first approximation toward an intervention that may optimize cognitive functioning in these children.

Motor development characteristics in children with fetal alcohol spectrum disorders (FASD)

Bertram, Chris P., University of the Fraser Valley; Pritchard Orr, Alison, University of the Fraser Valley; Keiver, Kathy, University of the Fraser Valley; Konarski, Ryan, University of British Columbia; Khaleel, Bassam, University of the Fraser Valley; Clarren, Sterling, Canada Northwest FASD Research Network

In the four decades since fetal alcohol syndrome (FAS) was first described, great strides have been taken to further our understanding of the morphological and functional impact of prenatal exposure to alcohol. It recent years, it has come to be understood that a host of variables including quantity, timing and frequency of exposure can lead to a multiplicity of outcomes that has come to be collectively termed fetal alcohol spectrum disorders (FASD). While our understanding of the cognitive, behavioral, and social impact of FASD has steadily evolved, our knowledge of the motor abilities of this population remains somewhat lacking. The current study was therefore designed to provide a detailed motor examination of 37 children (ages 6-14) with a confirmed diagnosis of FASD using the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). The results of the study indicated that children with FASD present with rather low overall percentile rankings in terms of overall motor ability. However, there was a clear bimodal distribution within our sample, such that approximately 40% of our sample ranked below the 10th percentile, and another majority group averaging near the 35th percentile. These findings are interpreted by considering the age and diagnostic subcategory of the groups along with a detailed breakdown of motor ability according to the eight subtests of the BOT-2.

Assessing the motor skills of children with autism spectrum disorders: A qualitative approach

Breslin, Casey, Temple University; Buchanan, Alice M., Auburn University; Blount, Asherah, Auburn University

Individuals with autism spectrum disorder (ASD) struggle to interpret auditory information, but have relative strengths in processing visual information. However, due to the communicative impairments used to produce a clinical diagnosis of ASD, it is difficult to ascertain if these children prefer settings utilizing visual as opposed to auditory information. The participant and first author in this study was the researcher, while the second author was the interviewer. The purpose of this study was to explore the participant's experiences through interviews conducted during a month long period in which the participant conducted motor skill assessments in three different formats. Interviews were recorded, transcribed, and analyzed, then read in search of major themes. We followed by searching for repeated data, and coding data into categories that were evidence-based (Cresswell, 2007). The last step of the process was done repeatedly until we finalized categories. Three major themes emerged, with subthemes. The three major themes were Participant Emotions, Research Protocols, and Children's Behavior. The sub-themes were then labeled with the

participant's own words (in vivo codes, Cresswell, 2007). With regard to the participant's emotions, the participant experienced enjoyment and frustration for the research process, and empathized with the children. Because there were three research protocols used in the study, the interview results naturally fell into those three, making these particular codes appear a priori. The three protocols were traditional-full sentences, picture schedule, and task cards. Further data emerged within each category regarding the participant's observations of the differences in the children's behavioral responses among the protocols. Finally, a third subtheme regarding children's behaviors indicated the children experienced self-stimulation, sensory issues, and distractions during the assessments. Findings show that the participant experienced difficulty communicating with the children using a traditional protocol. This led to feelings of frustration, however, the participant had an enjoyable and productive research experience. She further believed that the children's behaviors indicated their frustrations. As a result, practitioners doing motor skill assessments should consider behaviors by children with ASD as indicative of preferences in assessment modalities.

Changes in dynamic balance over time: Effects of the Feldenkrais method of somatic education

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As adults age, they typically limit their movement repertoires as performance on balance and other tasks becomes static or degrades. Alternatively, the Feldenkrais Method claims to improve function and promote flexible, adaptable behavior across the life span. To evaluate this proposal, we observed 8 participants in a 4-year Feldenkrais Professional Training Program (monthly segments 2/year) compared to a control (C) group matched by age (train = T 50.3 ± 7.0, C 52.1 ± 3.9), gender (6 women, 2 men per group) and CDC physical activity indicator (T 4.6 ± 1.2, C 4.4 ± 0.7). We tracked activity levels, health-related quality of life, and several movement tasks. This study focused on pre-to-post changes in 2 dynamic balance tasks: seated reaching task and star excursion balance test (SEBT). Each session we measured arm and leg lengths (mm) and assessed upper and lower limb mobility dominance. Participants performed 3 trials in all directions for both tasks with their dominant (D) and nondominant (ND) limbs. We normalized reach distances (mm) by limb length. For the seated reaching task, participants sat on a stool, held a water bottle at arm's length on a table, lifted it and reached as far as possible to replace it. Percent change was greater for the trained group than the control group in forward and lateral directions bilaterally (D forward: T 16.60%, C 2.25%; ND forward: T 16.78%, C 3.38%; D lateral: T 11.39%, C -5.10%; ND lateral: T 6.75%, C -7.51%). The SEBT involved standing on one foot and reaching as far as possible with the other foot along lines in 8 directions: anterior, anterolateral, lateral, posterolateral, posterior, posteromedial, medial, anteromedial. Percent change was greater for the trained group in 9 of 16 conditions, for the control group 3 times, and was similar 4 times. Given the low *n*, only 1 direction reached significance for each reaching task (seated D forward, time × group $p = .035$; SEBT D anteromedial, time × group $p = .03$). These initial findings suggest the Feldenkrais Method may effectively preserve or enhance dynamic balance with aging.

The ability to modulate peripersonal and extrapersonal reach space via tool use among the elderly

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In a general sense, spatial cognition is a critical ability of humans, through which one acquires and represents the environment. In most cases, using a tool to extend space alters action capabilities represented in the body schema, modifying an individual's representation of space. With increasing age, functional decrements in spatial representation are frequently observed, which may restrict daily activities such as using tools for postural control and locomotion (e.g., canes, walkers). Therefore, we examined older adults' ability to plan reach movements with their hand and tools of 20 and 40 cm in length. Twenty-seven participants aged between 55 to 92 years were divided into two age groups: = 75 years [n = 14, M = 67] and 75 > [n = 13, M = 80]. The task required participants to estimate reach via use of motor imagery in regard to seven targets randomly presented in peripersonal and extrapersonal space, with accuracy based on individual actual maximum reach. Conditions (Hand/Tool20 and Hand/Tool40) were presented in counterbalanced order. Each condition consisted of a block of 21 trials and a "switch-block" of 7 trials, i.e., switching to the other condition. The overall findings indicated no age group or condition differences; however, ANOVA results revealed a significant difference in the switch-blocks, suggesting that participants were significantly more accurate when they switched from Hand to Tool (extension) when compared to the switch from Tool to Hand (retraction). In addition, a correlation analyses indicated a negative relationship for accuracy in the Tool 40 condition and age. In view of the total sample, two findings warrant further consideration and study. For both tool lengths, retraction from Tool to Hand was more difficult than extension from Hand to Tool. And specifically to the 40-cm tool, accuracy decreased as age increased. In addition to gaining information about aging of the neuro-cognitive processes associated with spatial representation, these outcomes may have implications for physical safety and rehabilitation with older persons.

After school physical activities and preschoolers gross motor skills performance

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Previous studies indicated that organized physical activities are associated to gross motor skills performance in later childhood. However, it is not clear if the same premise holds true for early childhood. The aim of this study was to determine whether systematic after school physical activities affect the development of gross motor skills of preschool children. Based on questionnaire answered by the parents or relatives, seventy-two preschoolers were divided into two groups. The G1 was formed by children who were regularly engaged in after school physical activities (n = 36; 18 boys and 18 girls, mean age 4.5; DP = 0.7). The G2 was formed by thirty-six children age and gender matched with G1, but not regularly engaged in after school physical activities. The Test of Gross Motor Development (TGMD-2) assessed motor skill performance. Independent sample t-tests were used, and statistical significance was set at $p < 0.05$. The results showed no group differences for all the motor performance scores (locomotor, object control and gross motor quotient). Our preliminary results indicated that regular physical activity was not a factor that affected the motor skills of preschool children and it is confirming partially the theoretical proposition by Stodden et al (2008). Moreover, according to Smith and Thelen (2003), from a dynamic perspective it is important to understand the processes by which the everyday activities of children create developmental change—both the universal attainments and the individual pathways. In fact, the specificity of practice could be a task restriction impacting the motor development.

Because of this, we suggest that next studies should measure the intensity of physical activity as well as the type of skills used in those physical activities.

Gross motor skills in pre-term and full-term born preschoolers

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Pre-term infants usually show physical signs of prematurity in reverse proportion to the gestational age. As a result they are at risk for numerous medical problems affecting their developmental path. Developmental disability is one of the most typical consequences among several neurological issues, what in general, causes motor skill impairment. The aim of this study was to identify if prematurity would affect the levels of gross motor skills performance during childhood. Sixty preschoolers (20 boys and 40 girls; mean age = 4.5, $SD = 0.7$) were divided into two groups: G1, the pre-term ones, [$n = 30$; ≤ 37 weeks of the gestational age] and G2, with age and gender matched control full-term children [$n = 30$; ≥ 38 weeks of the gestational age). All children were from the same social-cultural living context. The gross motor skills were assessed by the Test of Gross Motor Development (TGMD-2). The test session was video-recorded for offline assessment. Two experts assessed the children's performance (inter-rater reliability = 0.87). The results showed no difference in the motor scores between the two groups. Despite of the individual restrictions caused by prematurity, these findings provide some evidence that pre-term children were able to achieve the same level of motor performance in the TGMD-2 test as compared to those typically developing.

Individual differences in the development of executive functioning and motor control in preschool-aged children

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Motor and cognitive development have historically been studied separately. However, recent research has demonstrated that motor and cognitive development are interrelated in many developmental disorders (e.g., children with ADHD, DCD) and in older children (Diamond, 2000). It is unknown if this relationship exists in younger children or if it only emerges in later childhood. Therefore, the purpose of the current project was to explore the relation between executive functioning ability (EF) and motor control in 101 typically developing preschoolers (ages 3 to 5). Participants completed the Stanford-Binet verbal and non-verbal subscales, six age-appropriate executive functioning tasks (measures of inhibitory control, working memory, and set-shifting), and the MABC-2 (measures of fine and gross motor abilities). When controlling for age and intelligence, positive correlations were found between several of the EF and motor tasks (significance level $p < 0.05$). Performance on the fine motor task of fitting coins into a box correlated with a measure of set-shifting ability (Conflict Card Sort: $r = .32$). Drawing within the lines of a maze (a fine motor task) correlated with Conflict Card Sorting ($r = .27$) and a task requiring the delay of instant gratification (Gift Delay: $r = .36$). The gross motor task of maintaining balance while walking tiptoe along a line correlated with Conflict Card Sorting ($r = .25$), two tasks requiring inhibitory control (children had to perform an action opposite to the one instructed by the experimenter: $r = .40$; $r = .26$), and Gift Delay ($r = .37$). The gross motor task of maintaining balance while

jumping on mats correlated with one of the inhibitory control tasks (r = .28). These findings suggest that a link exists between EF and motor abilities (gross and fine) in typically developing preschoolers. The general ability to inhibit actions might be strongly related to performance in both types of tasks. However, the relation between these abilities could be due to the motor component involved in the EF tasks (Best & Miller, 2010).

Latent intermanual asymmetries in 9-month-olds as revealed by kinematics

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Prior research has shown that in the second half of the first year, infants hand preference for reaching tends to dissipate. In this research we examined to which extent the lack of preferred hand use in 9-month-old infants reaching behavior would also be reflected in the control characteristics of the movement. To address this question, we analyzed the intermanual performance asymmetries present during bimanual and unimanual reaches in a group of nine infants. Infants were presented one object at a time, at midline, shoulder height, while fully supported in an infant seat. Reaching kinematics of both hands were collected using a Flock-of-Bird sampling at 120 Hz. The analyses focused on the first hand touching the object in those infants who did not display a consistent hand choice for reaching, such that performance between hands could be compared within subjects (N = 7). Statistical comparisons between left and right hand were made for bimanual and unimanual reaches. Multivariate analyses performed on the bimanual reaches revealed statistical differences between hands for mean velocity, velocity at contact, and trajectory straightness. Analyses on the unimanual reaches only showed significance for mean velocity. For both, unimanual and bimanual reaches, movement velocities were significantly higher for the left hand, and in bimanual reaches, the left hand path to the target object was significantly straighter. These preliminary findings suggest that intermanual asymmetries in reaching movements may remain latent even though hand choice in the second half of the first year may be subject to fluctuations.

A first glimpse at the visual process leading to action selection in 9 months old infants

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Adults can identify the features of an object and decide how to reach for it quickly. For example, adults can detect the handle of a cup in a cursory glance and direct their arm to that exact location to pick up the cup without effort. Even though infant reaching has been studied for many decades, it is unknown whether infants are capable of such precise perceptual-motor matching. Here we begin to investigate this question with 9 month olds. This study aimed to: (1) identify whether infants could select an area of an object visually prior to reaching; (2) assess whether they could direct their arm to that visually selected area successfully; and (3) determine which factors contributed to the formation of such visual-motor matching in development. Fifteen 9-month-old infants participated in this study. Infants, supported in a seat, were presented with relatively large objects (13 cm long) that offered a choice as to grasp location. The objects were initially presented out of the infants' reach, at shoulder height, and within a pre-calibrated area for 5 s such that an eye-tracker, located just below the pre-calibrated area, could record the gaze of the infants

on the object during its presentation. Once the 5 s had elapsed, the object was moved into infants' reaching space to permit grasping of the object. Looking patterns at the objects prior to reaching were analyzed to determine where infants directed their visual attention the most. The target area subsequently contacted was also identified. Infants displayed a looking preference for the areas of the objects that were larger and more salient. Also, these salient and most-visually-attended areas often corresponded to the areas to which infants directed their hand for grasping. However, such perceptual-motor matching between looking and grasping was more likely to occur when the preferred area of the object was visually attended for at least 1s of accumulated duration. It appears that the duration of visual attention to a specific area of an object is critical for action selection in 9-month-old infants.

The formation of perceptual-motor matching in infant reaching: A preliminary longitudinal study

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By 9 months of age, infants are capable of adjusting their reaching patterns to adapt the features of objects. How does such perceptual-motor match develop? We aim to address this question by comparing the patterns of visual exploration and subsequent reaching of objects between a group of 9-month-old infants (as norm) and 2 infants followed weekly from the age of 2.5 months. We focus on the visual and motor changes that occurred in those two infants 5 weeks prior and after reach onset. All infants were supported in a seat and presented with 13 cm long objects shaped like a mallet that offered different graspable areas. The objects were initially presented out of infants' reaching space, at shoulder height, and within a pre-calibrated area for 5 s such that an eye-tracker, located just below the pre-calibrated area, could record the gaze of the infants on the object during its presentation. Once the 5 s elapsed, the object was moved in the infant reaching space to solicit grasping of the object. Looking patterns at the objects prior to reaching were analyzed to determine where infants directed their visual attention the most. The object area subsequently contacted was also identified. The two longitudinal infants began to reach around 3 and 4 months respectively. Prior to reaching onset, their looking patterns were more distributed over the object as whole, but over the 5 weeks following reach onset, looking patterns were directed increasingly toward the sphere—the most salient area of the mallet. Patterns of hand contact with the object followed the same trend. Analyses aimed at assessing the rate of matching between looking and reaching revealed that in that 5-week period, infants learned quickly to direct their hand where they looked the most. By Week 5 of reaching, the looking and reaching patterns of the longitudinal infants resembled closely those of the 9-month-old infants. These data suggest that young infants can form a match between looking and reaching much more quickly than thought before, reflecting a rapid spatial alignment between vision and action.

Ability of elderly persons to estimate reach distances in different postural conditions

Cordova, Alberto, UTSA; Gabbard, Carl, Texas A&M University

Research indicates that the relative neurocognitive demands of estimating reach distances varies with the associated movement environment. It would seem that in any given action,

performers must take into account their initial conditions to plan for the scenario. It is this planning, action representation, which allows individuals to make predictions (estimates) about the external environment. From the sparse available information, there are indications of a decline with advanced age (> 64 years; e.g., Personnier et al., 2010; Skoura et al., 2008). Here, we examined the possible effects of advancing age during adulthood on motor imagery ability (action representation) in the context of estimation of reachability in two different posture conditions: seated and standing. We also examined the relationship of reach estimation to actual functional reach. Eighteen young adults (mean age 22.61 ± 3.01) and 33 older adults (mean age 66.00 ± 6.71) were assessed for estimated reach via use of motor imagery and for functional reach using the Functional Reach Test (FRT). Reach estimation was based on individual actual maximum reach; 7 target distances were randomly presented in peripersonal and extraperson space with participants receiving 5 trials per target. ANOVA analysis for total accuracy indicated differences between conditions, $p < .05$. In regard to the general direction of error, in the seated condition there were no differences between age groups, whereas when standing differences emerged with the older group underestimating while the younger group overestimated. In reference to the correlation between the reach estimation and FRT, only the younger group showed a significant relationship ($r = .56$ $p < .05$). In summary, these findings add to the general notion that there is a decline in the ability to mentally represent action with advanced age. Furthermore, it would appear that the elderly are more conservative in estimations and there is a weak correspondence between imagined and actual behavior.

Affordances in the home environment for motor development: A cross-cultural study

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For the past half century, considerable efforts have been devoted to map the relations between the home environment and selected aspects of child's development. A recent instrument was developed that aimed at assessing the affordances in the home environment, the AHEMD-SR (Affordances in the Home Environment for Motor Development Self-Report (Gabbard, Cacola, & Rodrigues, 2008). Although the AHEMD-SR gave insight into affordances in the home, it was focused on two specific populations from the United States & Portugal. Currently, there is limited research regarding validity of this instrument when used in different cultures. Therefore, the purpose of this study was to compare a sample of Middle Eastern children (Lebanon) to the normative sample that was used to validate the AHMED (United States and Portugal). The sample consisted of 592 families with children ages 18-42 months; where 367 families came from the American/Portuguese sample (199 males (54.5%) and 166 females (45,5%)) and 225 families were from Lebanon (125 males (55.6%) and 100 females (44.4%)). Results showed a significance difference between the socioeconomic statuses between groups. Concerning factor analysis, results indicated that the Lebanese group had five factors loading similar to the American/Portuguese sample but with variables loading differently. Interestingly the Lebanese group showed higher scores for affordances inside the home such replica toys and games. Our findings showed that the state of the environment may play a role in the affordances and development. Future work is needed to look at the specific loading and possible variables that may be included in the AHMED-SR when looking at different cultures that may have other limitations.

The influence of maternal health literacy on home affordances and early childhood motor development

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Mothers have a primary influence on the home environment and the opportunities that it provides a child for movement experiences. One factor that may influence the availability of home affordances is maternal health literacy (one's capability to access, comprehend, and use health information). Mothers with higher health literacy levels may provide environments that afford greater opportunities for the development of motor skills in early childhood (vs. those with low literacy). However, there is limited research examining this relationship. As such, the purpose of this study was to investigate the influence of health literacy on home affordances and motor development. Methods: Sixteen mothers (age = 32 ± 4 years) with a child between 18 and 36 months completed a health literacy battery: Rapid Estimate of Adult Literacy in Medicine (REALM) and the Test of Functional Health Literacy in Adults (TOFHLA); as well as an Affordances of the Home Environment Motor Development (AHEMD) assessment. The toddler (age = 31 ± 6 months) of each mother was also assessed for motor development using the Peabody Developmental Motor Scales, 2nd Edition (PDMS-2). Results: There was a significant correlation between maternal reading scores on the REALM with greater total variety of stimulation on the AHEMD ($r(15) = 0.73$, $p = 0.060$). Higher TOFHLA numeracy scores also related to more availability of fine ($r(15) = 0.73$, $p = 0.064$) and gross ($r(15) = 0.66$, $p = 0.108$) motor toys in the home environment. Increased variety of stimulation was also shown to be positively correlated with locomotion ($r(15) = 0.88$, $p = 0.008$), object manipulation ($r(15) = 0.95$, $p = 0.001$), and visual-motor integration ($r(15) = 0.85$, $p = 0.015$) scores on the PDMS-2. Conclusions: Mothers with higher health literacy levels are more likely to provide home environments that include a greater number of toys that facilitate fine and gross motor development, as well as a greater variety in overall stimulation. Moreover, children exposed to a variety of affordances demonstrate more proficient scores on components of motor development.

Sequence learning reaction time structure differs in children and adults

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When pre-structured sequences are presented, people tend to learn the sequence's structure (Reber, 1967; Cleeremans & McClelland, 1990). Both adults and children can learn sequences by either statistical computation (probability-structured) or chunking (segmental-structured) (Perruchet & Paction, 2006). However, there may be hidden but more generalized statistical/mathematical functions governing the sequence structures. Learning these functions hypothesizes that more generalized learning, or "learning to learn" is induced when one learns a given sample motor sequence. This assumes that if people learn a sequence and translate this into their performance, the performance would share the same functional properties as the sequential stimulus, such as lower reaction time (RT) for the stimulus with a higher probability (Hunt & Aslin, 2001). In this study, we examine the statistical/mathematical structures of RT time series for adults ($n = 8$), 10-year-old ($n = 12$), and 6-year-old children ($n = 8$), who perform a pre-structured sequence,

consisting of 10 repetitions of the same 10-element sequence, in a foot stepping task with six differently- located targets. Results from Valentini et al. (submitted) showed that all age groups learned the sequence as evidenced by decreased mean RT and increased mean RT to a novel sequence. However, when the statistical/mathematical structures of the RT data were analyzed, we found that the age groups' RT time series had different structures; the adults shared the most similar structure with the sequential stimulus (e.g., the same periodic behavior and auto- correlation pattern). The children, especially the 6-year-olds, did not learn the underlying sequence structure. It is hypothesized that their reduced RT performance results from alternative strategies, such as chunking, to learn the sequence segments, while not the whole sequence. This analysis and results provide future directions to investigate the development trajectories of the underlying mechanisms of motor sequence learning.

Comparison of motor unit activity in infants with peripheral vs. central neural lesions

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Background: Upper limb asymmetry after perinatal brachial plexus injury (BPI) is immediately apparent, yet is often identified later after perinatal stroke. This study aimed to determine whether spike shape analysis of surface electromyographic (sEMG) activity is a sensitive method to assess group, age and limb differences in motor unit (MU) activation in these infants post-injury. Methods: Fifteen infants 4 to 6-7 months of age participated; 5 with BPI, 5 with post perinatal stroke and 5 typically developing controls. We recorded 3 isometric, biceps contractions with bipolar electrodes, in each arm while the infant grasped a small dowel while the arm was held in 90 degrees elbow flexion and neutral forearm rotation. The 5 measures of MU activity computed were: mean spike amplitude (MSA), mean spike frequency (MSF), mean spike duration (MSD), mean spike slope (MSS), and mean number of peaks per spike (MNPPS). Resting baseline and peak muscle contraction, elicited by a tendon tap, were obtained from sEMG. We used a mixed model ANOVA with repeated measures to analyze differences in sEMG spike shape data for group, age and limb. Results: For the 3 groups we found a main effect for age in MSA (p = .02), MSF (p = .04), and MNPPS (p = .001). There was a group by age interaction for MSA (p = .0001), mean spike slope (MSS) (p = .0001), MSD (p = .0001) and MNPPS (p = .001). When analyzed separately, data from infants with BPI and post-stroke revealed a main effect of arm for MNPPS (p = .05); an age by arm interaction for MSA (p = .02); and a group by age interaction for MSA (p = .0001), MSS (p = .0003), and MSD (p = .0001). Thus, all 5 variables used to examine MU activity increased from 4 to 6-7 months in both arms of infants with BPI and controls. For the infants post-stroke, 3 variables decreased in the arm at-risk across age, while MSF slightly increased and MNPPS showed little change. Conclusions: Shape spike analysis of sEMG seems to be a sensitive method to assess MU activation in infants at risk for upper limb dysfunction. The increase in MSA, MSS, and MNPPS across age for infants with BPI and controls suggests that they learned to recruit higher threshold MU's during contractions. Conversely, the decrease in MSA and MSS and slight increase in MSF for infants post-stroke suggests that they increased the frequency at which the MUs fired to compensate for a decrease in MU recruitment and to generate sufficient force.

Walking strategies affect reaching behavior differentially in newly walking infants

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Learning to walk requires that infants maintain upright balance while learning to control the propulsive forces needed to move forward. Research has shown that infants begin to solve this motor task by using one of three whole-body strategies (i.e., stepping, twisting, or falling). This transition to walking was also found to induce a temporary increase in bimanual reaching while seated. This research aims to understand the extent to which the observed increase in seated bimanual reaching is tied to the type of walking strategy each infant adopts. We hypothesized that the arm use intrinsic to each walking strategy to control balance and create momentum will affect increased arm coupling during seated reaching differentially. Further, we hypothesized that this increase in bimanual reaching should also lead to an increase in bimanual grasping. Six infants (3 boys, 3 girls) were followed weekly from 7-8 months of age and until they had 4 months walking experience. At each visit, infants were prompted to reach for small objects presented at midline while seated in an infant chair. Once walking emerged, infants were also enticed to walk toward a target located 3 meters away. At each session, kinematics of reaching and walking were collected at 60 Hz using an Optotrak. Preliminary results supported our hypothesis that infants with different walking strategies also showed differential changes in reaching behavior around walking onset. Stepping and twisting infants increased their rate of bimanual reaching and grasping, while infants using the falling strategy did not show such an increase. We conclude that these differences occurred because in the stepping and twisting strategies, infants couple their arms as a mean to control balance and create forward momentum. In the falling strategy, forward momentum is created mainly by leaning the body forward. These results support previous interpretations that the increase in bimanual reaching observed during the transition to upright locomotion is related to the way infants use their arms to achieve this new locomotor skill.

Mentally representing sequential (fine-motor) finger movements: A developmental perspective

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Motor programming theory suggests that an integral component in an effective outcome is an adequate action representation (internal model) of the movements. Internal models make predictions about actions and enable successful planning and execution of movement. Whereas previous work has reported the modeling of actions engaging more gross-motor movements; namely the trunk, shoulders and limbs, little is known about the age-related ability to create internal models for action requiring fine-motor movements. Here, we compared imagined and executed movements of children representing ages 7-, 9-, 11 years and adults using a chronometry paradigm with a task involving sequential finger movements. The task required number recognition and ordering and was presented in three levels of complexity (Load): sequencing 3-, 4-, and 5 finger digits. Movement duration results indicated that 7-year-olds (slowest) and adults (fastest) were different from the other groups, $p < .01$, with no statistical distinction between 9- and 11-year-olds. There was a Load effect showing a decrease in performance as load increased, $p < .01$; this was evidenced across age groups.

Correlation analysis for imagined and executed movement times indicated that there were moderate significant correlations for 7-year-olds (r = .60, p = .01), 9-year-olds (r = .65, p = .01) and adults (r = .68 p = .005), but not for 11-year-olds (r = .45, p = .14). However, comparisons using Fisher's Z indicated no significant differences for age. In summary, whereas in the context of the task used here action representation and internal modeling are functional in 7-year-olds, development continues up to young adulthood. These results are the first to document the increasing convergence between imagined and executed movements in the context of fine-motor behavior—a finding that adds to our understanding of action representation in children.

Effects of a combined physical activity-, nutrition-, and behavior intervention on overweight children

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Against the background of the global problem obesity and regarding the fact that, in Germany, 15% of the children suffer from overweight and even 6% are obese (Kurth & Schaffrath Rosario, 2007), effective interventions and strategies preventing overweight in children are necessary. In this context, physical activity has to be considered as a resource enhancing health and wellbeing. However, there is a lack of studies concerning the effects of long- term interventions on physical and psychosocial aspects of overweight children (Summerbell, 2005). Therefore, the purpose of the present study was to examine the effects of a combined physical activity-, nutrition-, and behavior intervention in the setting of a sports club on overweight children (8 to 12 years) and their level of physical activity, physical and psychosocial resources as well as the reduction of risk factors for obesity (Wagner et al., 2009). At the beginning, in the middle, and at the end of the structured 30-week intervention phase, including a weekly physical activity class of 90 min and three nutrition- and parents- workshops, data giving evidence about anthropometric (BMI-SDS), physical (KATS-K), and psychosocial aspects (quality of life, KINDL; self-concept, FSKI) as well as data concerning the level of physical activity and inactivity (HBSC-index) the children (Intervention group: n = 17; control group: n = 20) have been collected. The results indicate significant main effects on physical (speed, strength, HBSC-index) and psychosocial aspects (quality of live, self-concept, self- efficiency) as well as on several risk factors of obesity (BMI-SDS). With the help of the program, participants realized that there was a need to change their way of life and that they themselves were able to put these changes into practice. The positive effects on the children's quality of life and their level of physical activity serve as a good basis for continuous changes in their behavior. Additionally, the chosen setting of a sports club simplifies the process of continuing different types of physical activity.

Effects of environmentally designed and direct instruction on the object-control skills of Hispanic preschool children

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The purpose of this study was to examine the effects of environmentally designed and direct instruction on the object-control skills of Hispanic preschool children enrolled in a Head Start program. A total of 94 Hispanic children, between the ages of 38-52 months, participated in the study. Participants were randomly assigned to a Direct Instruction group (DI, n = 38), an Environmentally Designed Instruction group (EDI, n = 35), or a control group (CON, n = 21). Participants in the DI and the EDI groups received an 8-week intervention

consisting of four 20-minute instructional sessions per week. The EDI group received tasks within lessons where the task constraints were manipulated to produce the correct motor skill pattern (Sweeting & Rink, 1999). The DI group received traditional instruction whereas the primary mode of instruction was demonstration and verbal cues to provide information about the skill. Children in the CON received no instruction on fundamental motor skills. The CON group participated in movement to songs consisting of four 20-minute sessions delivered over an 8-week period. Test of Gross Motor Development-2 (TGMD-2) was used to assess children's object control skills at the beginning and end of the 8-week sessions. TGMD-2 standard scores were measured and statistically analyzed using a 3 (group) × 2 (pre, post) repeated measures ANOVA. A significant Group × pre-post test ($F(2,91) = 54.34$, $p = .000$) was found indicating children in both DI and EDI groups elicited significantly higher TGMD-2 standard scores than the children in the CON group after 8-week intervention. It was concluded that Hispanic preschool children could improve their object control skills with implementation of the direct or environmentally designed instructions.

An online tool for assessing gross motor skills of individuals ages 6 months to 13 years

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Gross motor skills are gradually developed from birth and improved in early and late childhood. In order to promote gross motor skills, assessment on a regular basis is a primary process to determine overall status and track the rate of growth for children (Gallahue & Ozmun, 2006). A variety of gross motor skill assessment instruments such as Denver II (Frankenburg, et al., 1990) and TGMD II (Ulrich, 2000) have been widely used. These testing tools are well structured and easily accessible to scholars or practitioners. Nevertheless assessing gross motor skills can be a challenging for parents or caregivers who do not have knowledge of motor development or assessment procedures. Since parents or caregivers are in an important position to promote children' gross motor skills, providing convenient testing tool can help them assess their children's gross motor skills over long periods of time. Therefore, the purpose of this study was to develop an online-based tool for assessing gross motor skills in individuals ages 6 months to 13 years to be used by parents and caregivers. The research process followed five steps: a) Three main test items (locomotor, non-locomotor, and manipulative skills) and sub components for each item were selected from previous test protocols (i.e., Denver II and TGMD II). The items were tested on 245 children as well as their caregivers to establish test validity and reliability for standardized test. b) Three motor development specialists determined test-items through survey of caregivers and face validity for a large sample test. c) The standardized test was conducted with 1,993 participants ages 6 months to 13 years to set a standard norm for each age group, and three or five sub components on each main item were confirmed for each age group. d) Based on the results of the standardized test, a final on-line based assessment tool and specialist guidelines were established. We expect that our assessment tool helps caregivers assess their children' gross motor skills and judge their developmental characteristics.

Developmental trajectory of locomotor experience in cruisers: Its role in walk onset

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Introduction: Previous researchers (Adolph et al., in press) reported a surprisingly high number of steps generated per hour (~2,400) by newly walking toddlers, as they improve

their skills. Here we focused on infants' behaviors that precede and facilitate walk onset itself. What are infants doing and how does that impact the emergence of their first independent steps? Methods: We tested 10 infants monthly in their homes, from cruise onset (*M* age = 8 months) until walk onset (*M* age = 12 months). We videotaped them for 60 min during a time of day parents reported their infant had freedom to play and move freely, then collected anthropometric and concurrent motor skills status (Bayley Scale of Infant Development III). Using OpenSHAPA software we coded the videos for all gross motor activities: frequencies, durations, and context. Results: A one-way ANOVA for infants' last 3 test sessions showed a significant increase in locomotion duration [Walk Onset (WO)-2, WO-1, WO] ($F(2,17) = 3.361$, $p = .05$); due mostly to increase between WO-1 & WO of 243.37 s ($p = .072$). Specifically, cruise duration changed significantly between visits ($F(2,23) = 10.554$, $p = .001$), increasing 14.9% from WO- 2 to WO-1 ($p = .082$) and decreasing 29.6% from WO-1 to WO ($p < .001$). Cruise step (CS) number also changed significantly across time ($F(2,17) = 9.027$, $p = .002$), increasing by 88.44 steps from WO-2 to WO-1 ($p = .027$) and decreasing by 67.57 steps between WO-1 and WO ($p = .002$). Discussion: By increasing overall locomotion and specifically cruise duration & steps up to one month prior to WO, infants build the muscle strength, postural control, proprioception, and confidence to take their first independent steps. This increase over time in physical activity is comprised of infants practicing a variety of locomotor patterns, strengthening underlying subsystems, and learning to adapt to various intrinsic and extrinsic factors. Further analyses will address the impact of context and motivators influencing locomotor choices in pre-walking infants.

The therapeutic role of imagery on the functional rehabilitation of a stage II shoulder impingement syndrome

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Motor imagery (MI) is the mental process by which an individual covertly rehearses a motor sequence without any motor output. MI has been used as a complementary therapeutic tool for motor recovery after both central nervous system disease or stroke and peripheral injuries. Here, we investigate, for the first time, the use of MI as a possible preventive tool. We selected 16 participants suffering from a stage II shoulder impingement syndrome without disruption of the rotator cuff (mean age = 46.3 years). The aim was to investigate the therapeutic efficacy of MI on shoulder mobility and pain to avoid reaching the third stage of the syndrome. All participants were given the same anti-inflammatory treatment and were randomly assigned to either a MI or control group. They underwent the same physical therapy program carried out by the same physiotherapist, including 10 sessions of 1 hour each. In the imagery group, MI exercises were completed during rest time between two sets of exercises, while the control group was subjected to a period of neutral activities during equivalent time. The following dependent variables were measured before session 1 (pre-test) and after session 10 (post-test): Shoulder functional assessment (Constant score), Range of motion, and pain (Horizontal Visual Analogue pain Scale). Data revealed a significantly higher Constant score in the MI than in the control group during the post-test ($p = .02$). Participants subjected to the MI intervention further displayed greater movement amplitudes for flexion ($p < .001$), extension ($p < .025$), and lateral rotation ($p < .001$) movements. Finally, the MI group showed greater pain decrease from the pre- to the post-test ($p = .05$). These results not only support the therapeutic effectiveness of MI, but also provide evidence that MI can have a preventive function along with classical therapy. Accordingly,

MI is likely to enhance mobility and decrease pain in patients suffering from a stage II shoulder impingement syndrome, hence postponing or even protecting from passing to stage III that may require surgery.

Upper limb and head orientation asymmetry in motor activity of newborn infants up to 3 months old

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The study of manual asymmetries in early infancy suggests a fluctuating, ever-changing process. Stability is acquired gradually with age but the moment when lateral preference is defined varies greatly among the authors. Longitudinal studies in order to understand the development of manual asymmetries and its correspondent fluctuations across the development are few. This study aims to characterize upper limb asymmetries and lateral head orientation in infants, from birth up to 3 months old. A behavioral observation process was used on a convenience sample ($n = 20$) of newborn infants during the postnatal period. Filming was carried out using a digital camera, on three repeated occasions. The analysis was focused on the sum of the movements of the head rotation and of the upper limbs and the results describe lateral activity, in terms of preference and stability during this 3-month period. Our results show a bias for symmetry, with a more intense activity of the left upper extremity during the first three months of life. There were no significant biases for lateral direction in the three moments under analysis. Future research in this subject should address the duration of the movements as well as their frequency in a larger number of occasions.

Relationship among motor skill development, aerobic capacity, body composition, and perceived competence in fourth grade school children

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Low proficiency of motor skills, low fitness levels, and low perceived competence have been identified as potential barriers to participation in physical activity among children; however, there is limited evidence examining the interrelationships among these variables. The purpose of this study was to examine the relationship amongst fundamental motor skill development, health-related fitness level, and perceived competence in fourth grade students. Participants included 137 fourth grade children (67 males; 70 females) from three schools. Two assessments of health-related physical fitness—the PACER as a measure of aerobic capacity and body mass index (BMI) as a measure body composition—were administered. The Test of Gross Motor Development-2 (TGMD-2) was administered to assess locomotor and object-control fundamental motor skill performance of the participants on 12 skills. Participants' perceived competence (PC) in six domains was calculated from scores on the Self-Perception Profile for Children (SPPC). According to Fitnessgram guidelines, 29.5% of participants fell below the standards for aerobic capacity and 29% were considered at an unhealthy weight. TGMD-2 (mean ± *SD*) and SPPC (mean ± *SD*) scores were high. Stepwise regression results indicated that the most significant predictor variables were aerobic capacity (predicting PC, BMI, and motor skills), object-control skill performance (predicting PC and aerobic capacity), and the SPPC academic domain (predicting BMI), athletic domain (predicting BMI and object-control skills), and physical appearance domain (predicting aerobic capacity and object-control skills). The findings

suggest that children and adolescents should maintain a healthy BMI, increase their aerobic capacity, and engage in fundamental motor skill development (especially object-control skill development) at a young age. Parents, teachers, and coaches should encourage this behavior as well as focusing on enhancing the children's and adolescents' competence, particularly in academic, athletic, and physical appearance domains.

Motor ability and cognitive function in youth sport

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Recent research has described the relationship between physical activity and cognition in both humans and non-human animals. To date, the research with humans has mostly focused on the effects of cardiovascular exercise on cognitive processes. The present study aimed to extend recent research by investigating the possibility of differential cognitive function depending on the motor ability. We performed a several test to view motor ability by the test of KOSTASS (Korea Sport Talent Search system). This test examined the ability of instantaneous reaction force, muscular strength, muscular endurance, coordination, and flexibility. We also examined cognitive functions by the K- Raven test. This test evaluates a child's important cognitive process by using non-verbal colored progressive matrices. To analyze the relationship between the two test results, 39 participants' data were used. Participants were elementary school students and had regularly participated in youth sports programs of Seoul National University. The results showed there were positive relationships between motor abilities and cognitive functions especially in coordination performance (basketball throw) score. These results reflect that the coordination capacity is highly associated with cognitive abilities. Furthermore, our data suggest that motor ability like coordination beyond the simple physical fitness can improve cognitive function of young children who regularly participated in youth sports programs.

Mechanisms underlying developmental changes in motor task performance in children: The role of Achilles tendon stiffness

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Motor development is a multi-factorial process, which is influenced by improvements in motor unit recruitment and the physical development of the musculoskeletal system. Within this context, the elastic properties of tendons play an important role. Tendon stiffness increases with age during childhood. Such increases are associated with a greater capacity for maximum force production during single-joint tasks. Further, leg stiffness is positively related to complex motor task performance. This positive relationship becomes stronger with age during childhood. As leg stiffness is influenced by both passive elastic structures and active muscle contraction, it is of interest to differentiate between active and passive contributions to the relationship between leg stiffness and complex motor task performance during childhood. Here we asked whether Achilles tendon stiffness is related to vertical jumping performance and if this relationship would differ between children and adults. Thirteen children (8-9 years) and 8 adults (20-25 years) performed three countermovement jumps on a force platform. Mean power produced was determined by the product of ground reaction forces and vertical centre of mass velocity. Achilles tendon stiffness, obtained from a combination of ultrasonography, motion analysis and isokinetic dynamometry, was calculated as the slope of the relationship between tendon force and elongation. Within each group, tendon stiffness was correlated with the mean power of the highest jump. In adults, we observed a significant

negative relationship between Achilles tendon stiffness and mean power production (50% of explained variance). In children, this relationship was markedly lower and non-significant (8% of explained variance). The results suggest that in addition to factors that are actively modulated by the central nervous system, passive properties play an important role within the context of age-related increases in muscular power production during complex motor tasks. Such findings have important implications for youth coaches and pediatric clinicians.

Developmental trajectory of bone mineral content in infants with typical development and myelomeningocele

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Introduction: Histological studies show that bone mineral content (BMC) begins to increase in utero and continues throughout childhood, impacted by activity and nutrition. But referent databases and standard normalization procedures for BMC do not exist for infants. To be able to monitor the impact of interventions for infants at risk for developing low bone density, such as myelomeningocele (MMC), normalization procedures need to be developed. Here we compare potential normalization procedures for data collected via dual-energy x-ray absorptiometry (DXA) for infants. Methods: We tested 12 infants with MMC and 12 infants with TD, distributed evenly across ages 1-12 months at the University hospital clinic, using a GE Lunar DXA scanner. We placed sleeping infants in supine anatomical position on the scanner bed; scans took 2 min. Using the "Infant Total Body" data collection and analysis software, we reviewed data after each scan and retested if movement artifact was observed. Post-scan we collected anthropometric data. We then normalized infants' data to segment lengths and to segment masses. Results: Our preliminary results support our hypotheses that (a) normalized BMC in infants' legs increases across the first year in both groups, (b) the difference between groups widens with age, and (c) group differences do not hold for normalized total body BMC. Further, our data suggest that normalization to segment length of interest (e.g., leg) is a reasonable choice and more useful than normalization to segment mass. Discussion: Results suggest that DXA scan data can be used in research, when normalized to body segment length and total body length measures to track BMC in infants with TD and MMC, and can reveal meaningful differences between populations. This technique holds potential to assess the impact of early activity and nutrition interventions for infants with and without bone growth problems.

Correlation of motor skill, mental rotation and working memory in 3- to 6-year-old children

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Introduction: A general relation between motor abilities and cognition in children is assumed (Sibley & Etnier, 2003), but the details of this relationship remains unclear. Spatial ability, one aspect of cognition, has been related to motor abilities in 5- to 6-year-old children using mental rotation (Jansen & Heil, 2010). Working memory is an important part of cognitive processing but its role in mental rotation is unclear. The aim of this study was to assess the relationship between motor abilities, mental rotation, and working memory processes in preschool children. Method: Sixty-five children (33 girls: 5.13 ± 0.89 years; 32 boys: 4.86 ± 1.04 years) from a German kindergarten took part in the study and were tested on two different test days. Mental rotation was assessed using a paper, pencil, and

picture mental rotation test: the children had to compare an upright picture with pictures at different angles. Motor abilities were measured with the Movement ABC-2. The working memory test consisted of the Digit Recall Test and the Corsi Block Tapping Test. Results: High correlation between working memory, motor abilities, and mental rotation were detected. The multiple variable regression revealed that 56.9% of the variance ($R^2 = .755$) is explained by the predictors "digit span forward" and "Corsi forward" ($F(2,64) = 40.97$, $p < .001$). We found gender differences in both the digit span tests and the motor tests with girls outperforming boys. Discussion: In preschool children the relation between motor ability and mental rotation (see Jansen & Heil, 2010) diminishes when working memory processes are included in the analysis. Whether working memory processes or executive processes are mediators for the relationship between motor and mental abilities must be investigated in further studies.

The effect of a picture activity schedule on performance of the MABC-2 for children with autism spectrum disorder

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The purpose of this study was to examine the impact of an assessment protocol utilizing a picture activity schedule on the performance of the Movement Assessment Battery for Children-2 (MABC-2) by children with autism spectrum disorder (ASD). Participants ($N = 25$, ages 5-11, male = 20, female = 5) performed the MABC-2 under two different protocols (i.e., traditional protocol and picture activity schedule protocol). MABC-2 percentile scores were measured and statistically analyzed using a within-subjects repeated measures ANOVA. Results indicated that the picture activity schedule condition showed significantly higher MABC-2 percentile scores (12.4th) than the traditional protocol (1.1th). The findings suggest that the picture activity schedule protocol may elicit better motor skill performance on the MABC-2 by children with ASD.

The non-conscious effect of autonomous and controlled priming on exercise goal session duration

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In physical activity contexts, research focusing on environmental stimuli has shown that priming autonomous and controlled motivational orientations can subconsciously influence individuals' motivational responses, as well as indices of task performance. In this prospective cohort study, participants were randomly assigned to an autonomy prime group, a controlled prime group, or a neutral group in which no priming material was presented. We aimed to investigate whether priming autonomous versus controlled motivation prior to explicit goal setting for exercise would result in differences in the number and duration of (a) exercise sessions stipulated in individuals' exercise goals, and (b) exercise sessions performed over the following week. We recruited 147 undergraduate students ($M_{age} = 18.58$, $SD = 2.04$, 52 males, 75 females), and delivered the prime via a scrambled sentence task, based on research by Levesque and Pelletier (2003). A MANOVA revealed a significant multivariate effect for the priming manipulation, $F(2,128) = 2.52$, $p < 0.02$, partial $\eta^2 = 0.91$, with autonomy-primed individuals ($M = 57.72$ min, $SD = 37.42$) setting exercise goals that included exercise sessions of longer duration than the controlled-primed ($M = 44.11$ min, $SD = 27.77$), $t(96) = 2.01$, $p < 0.01$ and neutral groups ($M = 37.09$ min, $SD = 20.47$), $t(94) = 3.26$, $p < 0.01$ $d = 0.67$. Bootstrapping procedures (Preacher & Hayes, 2008) provided evidence

of an indirect relationship, (F 2,103) = 3.13, p = .048, between priming manipulation and the length of individuals' exercise sessions, via an effect on exercise goals. Specifically, those who reported longer intended exercise sessions (i.e., exercise goal) engaged in longer exercise sessions over the following week. These findings highlight the potential influence that priming autonomous motivation may have in relation to individuals' exercise aspirations and engagement, and may have important practical implications in terms of providing a 'resource light' intervention for supporting physical activity participation.

Angular movement of the hip during the acquisition of independent gait under different surface conditions

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Independent gait is a complex action, involving many systems and constraints that interact with each other. Studying independent gait involves understanding the changes and restrictions that may interfere with the process of acquiring motor skills. Thus, the present study aimed to analyze the changes in angular motion of the hip during the acquisition of independent gait performed under two surface conditions. We evaluated 11 infants who were capable of independent walking (8 steps) from a nursery in Londrina-Pr. The infants were encouraged to walk independently on rigid (RS) and deforming surfaces (DS). Testing was conducted for a period of four months, with a total of eight evaluations sessions occurring every 15 days. All sessions were filmed and analyzed using the Ariel Performance Analysis System (APAS version 1.4). The data were normalized (0 to 100% of the gait cycle) and analyzed descriptively (mean and standard deviation) to characterize the sample. We calculated the effect size (Cohen's d) between the different surfaces on the angular movement of the hip. The results showed a high effect size between the surfaces on the sessions 1, 2, 4 and 8; medium-to-high effect size between the surfaces on the sessions 3 and 6 and low effect size on sessions 5 and 6. We concluded that babies were sensitive to the changes of surface, modifying the angular movement of the hip, in most sessions. The most noticeable characteristic was the fact that children had a more flexed angular movement of the hip in almost all of the step cycles. This occurred in both conditions, with greater emphasis on the deforming surface, indicating an instability in the conduction of independent gait at this age.

Bimanual coordination in children: Manipulation of object distance

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Many tasks require the performance of bimanual movements where both limbs reach-to-grasp separate targets. Although bimanual performance has been studied in detail in adults, few studies have examined how children coordinate the movements of the two hands during symmetric and asymmetric bimanual prehension. Thirty right-handed children were divided into younger (4-6 years, n = 14) and older (7-10 years, n = 16) groups. Their task was to reach out to grasp cylinders located at near and far positions in either unimanual or bimanual conditions. During bimanual symmetric conditions, participants performed movements with both hands towards two objects located at the same distance (both near or both far) while in the bimanual asymmetric conditions they reached for objects at different distances. Kinematic data were obtained for the index finger, thumb, and wrist of

both hands using a VisualEyez (PTI Phoenix) 3D motion capture system. Results of the kinematic analyses indicated that the young children were slower than the older children in completing both the unimanual and bimanual tasks. Group also interacted with condition for movement time ($F_{5,140} = 4.57$, $p = 0.001$) indicating that movement time costs associated with grasping objects in incongruent conditions were significantly larger for the younger compared to the older children. Finally, large relative timing differences at the start (Young = 84 ms, Older = 25 ms) and end (Young = 154 ms, Older = 86 ms) of bimanual movements and considerably weaker spatial coupling was seen in the younger compared to the older children. The larger movement time costs and weaker temporal and spatial coupling seen in the younger children may be associated with an immature visual attention selection mechanism. Specifically, while older children may be able to effectively coordinate shifts in attention during movement completion, the less developed selective visual attention mechanism in younger children may have resulted in both a slowing and decoupling of movement execution for the incongruent tasks.

Eye gaze metrics as a new direction for movement imagery and action observation

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Movement imagery and action observation have been used regularly by sport and exercise psychologists as part of mental skills training programs and the literature to support their use is extensive. There has, however, been an underlying assumption, based on the burgeoning 'neural equivalence' theories, that performers' attention during these ubiquitous interventions is 'matched' to that which they possess in physical task conditions. To date, there are no studies in the sport and exercise literature to support this contention. If, as a number of authors have suggested, eye gaze metrics can provide an indirect marker of attention, it is feasible to propose that researchers should consider the congruence of eye movement metrics during movement imagery and action observation and compare these to the metrics seen in physical conditions. Manipulation of the intervention conditions to increase the congruence would seem warranted to provide further support for the efficacy of these popular psychological skills. This paper will present research from our laboratory and others that have demonstrated congruence in gaze metrics between movement imagery, action observation and physical execution of a simple arm movement. We will also argue that performance improvement occurs in visuomotor tasks following manipulation of discrete gaze metrics. Specifically, fixations; periods of time when eye is relatively stable and considered to reflect information processing, positively influenced by skill learning and negatively influenced by anxiety (e.g., Causer et al., 2010; Causer et al., 2011). We will also present research from the clinical domain where rehearsing effective temporal and spatial execution of eye movements (saccades) during gait has been shown to improve locomotion ability (e.g., Crowdy et al., 2002). We suggest eye metrics provide an important marker of movement imagery and action observation effectiveness in performance and clinical settings. The benefits of the objective, dynamic and real-time nature of this marker are discussed.

Effects of a 15-week exercise intervention on gait in community dwelling older adults

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Introduction: 1 in 3 older adults will experience a fall each year. Falls are the leading cause of accidental death in adults over 65 years, and are the leading cause of nonfatal injuries

and hospital admissions for trauma. Falls often lead to adverse changes in confidence and lifestyle that trigger a cyclical decline in health, balance, and gait. Some components of gait include velocity, double support time, stride length, and heel on/off time. Purpose: To analyze the impact of exercise interventions (traditional group fitness program, a Wii fitness program, and a Pilates fitness program) on older individual's gait characteristics. Methods: 110 community dwelling seniors were randomized into 1 of 4 groups (Control, Wii, Traditional, Pilates). Interventions were delivered 3 times per week, for 10 - 15 weeks. The GAITrite Electronic Walkway was used to assess gait characteristics before and after the intervention. Results: Significant differences were found for velocity (p = .027), step length (right side; p = .079), double support time (right side; p = .048), double support time (left; p = .071). stride velocity (left side; p = .040), and stride velocity (right side; p = .046). Conclusion: The results indicate that these exercise interventions were successful at improving gait characteristics. It appears that the gait characteristics that saw the most improvement were step length, double support time, and stride velocity. These gait improvements may be indicative of improved balance and/or improved confidence. These results show that significant gait improvements can be achieved by these exercise interventions, and older adults should participate in exercise interventions targeting strength and coordination in order to improve gait and balance.

The influence of time spent in outdoor play on daily and aerobic step count in Costa Rican children

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Encouraging children to engage in outdoor play contributes to their physical activity levels (Burdette & Whitaker, 2005). However, outdoor play is not fully understood with respect to children's participation in physical activity. The purpose of this study was to examine the influence of time spent in outdoor play on daily physical activity in 5th grade Costa Rican children. Children (N = 190) wore Omron HJ-720 ITC pedometers for one week to assess step count and aerobic steps (>60 steps/min; duration > 10 min). Self-report outdoor playtime was measured by the Children's Outdoor Play Survey. Participants were placed into one of three groups based on the time spent in outdoor play (Group 1: < 1 hr of outdoor play/day; Group 2: 1 to 2:59 hr; Group 3: 3+ hr). Four 2 (Sex) × 3 (Groups) ANOVAs revealed a significant effect for Groups, p = .018, and Sex, p = .004, on step count for the weekdays. Post hoc tests showed that step count was significantly lower for Group 1 (M = 9053, SD = 2469) compared to Group 3 (M = 10,905, SD = 3792), p = .018. Girls (M = 9503, SD = 2735) acquired significantly fewer steps than boys (M = 11,261.21, SD = 3990) for the weekdays, p = .018 and weekend days (girls M = 7946, SD = 3505; boys M = 9412, SD = 4568), p = .029. Girls (M = 1345, SD = 1092) averaged fewer aerobic step counts than boys (M = 2028, SD = 1566) for weekday, p = .001, and weekend days (girls M = 909, SD = 1251; boys M = 1470, SD = 1623), p = .015. Children who spent three or more hours in outdoor play had higher step counts than those who spent less than an hour. In addition, daily step counts and aerobic step counts for the weekend days were lower for Costa Rican 5th graders compared to weekdays. Boys engaged in more daily steps and aerobic steps than girls all days of the week; however, few children met the daily step count recommendations (weekdays = 25.8%; weekends = 20.6%). Costa Rica's open play areas and outdoor recreation may be an intervention strategy to engage children in physical activity and reduce sex disparities in physical activity rates.

The relationship between fundamental motor patterns and motor ability in young children

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It is believed that young children with high motor ability acquire more mature and variable motor patterns compared to those with low motor ability. However, relatively few studies have simultaneously examined both the frequency of motor patterns and motor ability. To address this gap, this study aimed to investigate the difference between the appearance frequency of fundamental motor patterns during free play in children according to their motor ability. First, six young children (3 boys and 3 girls) with high motor ability and six (3 boys and 3 girls) with low motor ability were selected according to the preschool children's motor ability test, which is a revised version of the method used by the sport psychology laboratory of Tokyo University of Education (e.g., standing long jump, and softball throw). The children's movements during free play were recorded using a video camera and classified into 37 fundamental motor patterns consisting of locomotor skills and manipulative skills, based on the observational method of Sugihara et al. (2011). These 37 fundamental motor patterns were grouped into three indexes (isolated, simultaneous combination, and sequential combination movement pattern). Finally, each isolated movement pattern was classified according to the variation (e.g., jump ahead, jump backward, or jump a little.). The results showed that the appearance frequency of each index in children with high motor ability was significantly higher than that in those with low ability ($p < .05$). Further, the children with high motor ability showed greater movement variations within the isolated motor patterns compared with those with low motor ability ($p < .05$). Thus, it was shown that both the number of movement combinations and variation is related to the development of young children's motor ability. These results suggested that various movement experiences were important for motor development in young children.

A mathematical model to explore the mechanisms underlying the development of independent sitting in infants

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When infants first start to sit independently they are unstable, and only able to remain upright for short periods of time. However, over a 2-month period, their sitting proficiency drastically improves. Although multiple factors have been linked to the development of sitting, models that identify the specific mechanisms have not been developed. In this study, we developed, and subsequently analyzed, a mathematical model to explore the neuro-mechanical factors that contribute to improved postural stability in sitting infants. We used an inverted pendulum, incorporating active and passive elements, to model the sitting infant. Similar models have been used to model adult standing posture (Peterka, 2003; Mauer et al., 2004); however, no such model currently exists for infants. The analysis specifically examined how active feedback with varying time-delay and passive muscle dissipation contributed to the stability of a sitting infant. The active feedback was produced though a proportional-integral-derivative (PID) controller. The PID controller generates a corrective torque based proportionally off the error in position and the time derivative of

position. The gains of the PID controller were set lower than those utilized in adult models to account for the underdeveloped nervous system of the infant. It was found that neither neuro-muscular time delay nor muscle dissipation greatly influenced the stability of the utilized model. This finding was surprising given that both parameters significantly influence adult postural models. In contrast, the gains associated with the PID controller had a significant influence on the predicted stability. Such findings suggest that the important difference between infant and adult postural sway may not be the time it takes to process information, but rather the speed and magnitude over which postural corrections are made. The phenomenological differences between previous adult models and the current model likely stem from the comparatively low inertia of the infant and their underdeveloped neuro-muscular system.

The effects of aquatic exercise on static and dynamic balance in children with cerebral palsy

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The effects of aquatic exercise (AQE) on various physiological and psychological outcomes have been well documented in children with cerebral palsy (CP) in recent years. However, few studies specifically addressed how balance is affected by AQE. The purpose of this study was to investigate the effects of AQE on balance in children with CP. A case study approach with multiple data points was employed for this study. Four children with spastic CP (age 7 to 14, GMFCS level I and II) participated in 40 min of AQE 3 times a week for 7 weeks. Each session included warm-up, balance training, mobility exercise, and cool down. Balance outcomes were measured four times: pre, mid-point, post, and 7-week follow-up intervention. Biomechanical balance tests were administered on computerized posturographic equipment with dual force plates (Smart Balance Master, Neurocom International, Clackamas, OR, 2010). Comprehensive balance assessments were performed using test protocols in the equipment, which were Sensory Organization, Motor Control, Adaptation, and Limits of Stability tests. The tests examined multifaceted changes in balance, based on postural sways profiles, ground reaction force data, and automatic postural response time under various conditions. Results were analyzed using visual analysis of trend graphs from each case. One participant showed a 25% increase in the Equilibrium Score from the Sensory Organization Test, a measurement of postural sway during static standing. Two participants showed systematic improvement in automatic postural reaction time by a decrease in latency, the involuntary reaction time in random anterior and posterior surface translations while static standing. The results suggest that children with CP can improve dynamic balance and balance-related motor adaptation skills, though may have difficulty improving static balance through a 7-week AQE program. The interpretation of our study outcomes must be limited for generalization due to the nature of a case study, as well as, the large variability of physical conditions among children with CP.

Neural correlates of manual and oral movements in young and older adults

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Explaining why there is age-related reorganization of the central neuromuscular system will be advanced by identifying motor networks that are more preserved than others. In

behavioral tasks, age-related differences in fine manual performance have been suggested to occur to a greater degree than gross motor tasks. For fine motor tasks, it is debated whether oral motor control is more preserved than manual motor in the aging process. However, it is not known; whether age-related differences in blood-oxygen-level-dependent (BOLD) activity exist that differentiate finger and oral motor effectors. This study compared the neural circuits associated with finger, lip, and tongue tapping in young and old adults. Fourteen healthy young and fourteen old adults completed randomized tapping tasks with their all their fingers, their tongue, and by pursing the lips twice per second during functional magnetic resonance imaging (fMRI). As expected, robust somatotopically organized activity in the primary motor cortices were identified in both groups. An increased extent of BOLD activity in primary motor cortex was identified in older adults compared to younger adults in all primary motor regions. Additionally, a group by effector comparison revealed uniquely increased BOLD activity for lip pursing and tongue tapping. These findings point to increased recruitment of cortical motor tissue in older adults despite an absence of differences in task performance.

Strength and/or muscular endurance in children with DCD

Oliveira, Marcio A., University of Maryland; Ramalho, Maria Helena da S., Federal University of Juiz de Fora

Increased performance strength in children has been well documented in the literature. However, there is a lack of evidences whether this applies to those with developmental coordination disorder (DCD). In this study we used current strength health-related physical field tests to assess upper and lower body muscular strength and/or muscular endurance in children with DCD. Twenty-two children with DCD ($M = 11.1$, $SD = 1.1$ years), and twenty-two age-and gender-matched typically developing (TD) children ($M = 11.3$, $SD = 0.9$ years) with no history of any medical or orthopedic conditions participated in this study as subjects. Children with DCD were defined as those with scores at or below the 5th percentile on the Movement ABC Test. Typically, developing children were those whose scores on the test were above the 30th percentile. The children were asked to perform a series of randomized strength field tests such as the pull-up and flexed arm hang tests (AAHPERD, 1988; CF-AAU, 1987; PCPFS, 1987) push-ups (CF-AAU, 1987; PCPFS, 1987) modified pull-ups (New York State Education Department, 1968; Ross & Pate, 1987), horizontal jump, vertical jump, and grip force with both hands. Trained research assistants administered the five field tests, and the procedures for each test were strictly followed during each testing session. The results showed no group differences across all the strength tests, suggesting that lack of muscular strength is probably not one of the factors that contribute to the lower motor skill performance of children with DCD. However, further laboratory measures are needed to confirm these findings. Previous research has shown that performances on currently used field tests of upper and lower body muscular strength/endurance are not significantly correlated with laboratory measures of absolute muscular strength, or muscular endurance in 9- to 10-year-old children.

Development delay of finger torque control in children with DCD

Oliveira, Marcio A.; Clark, Jane E.; King, Bradley R., University of Maryland

Few studies have examined the developmental trajectory (i.e., age-related changes) of behavioral impairments in children with developmental coordination disorder (DCD).

An open question in the current literature is whether this trajectory is delayed or different compared to their typically developing (TD) peers. Such an investigation is significant as it may provide insights into whether the behavioral impairments persist, progress or resolve as a function of age and/or development. We examined whether the behavioral impairments in finger torque control evident in children with developmental coordination disorder (DCD) follow a delayed or different developmental trajectory as compared to their typically developing (TD) peers. Children with DCD (n = 36 [18 males; 18 females]; mean = 9.6 years; SD = 1.7 years) and TD children (n = 36 [15 males; 21 females]; mean = 9.6 years; SD = 2 years) between 6.8 and 12.6 years of age completed finger torque control and maximum finger torque production tasks. Group means and cross-sectional age-related landscapes of the two groups were compared. Inclusion criterion for children with DCD was a Movement Assessment Battery for Children (MABC) score below the 5th percentile. Children with DCD were more variable ($p < 0.001$), less accurate ($p = 0.007$) and less irregular ($p < 0.001$), on average, in their finger torque control compared to their TD peers, despite producing nearly equivalent levels of maximum torque ($p = 0.49$). Despite these mean differences, the cross-sectional age-related changes in torque control were similar in the two groups (all $p > 0.05$). The developmental trajectory of finger torque control in children with DCD, as compared to TD children, is delayed. This suggests the behavioral deficits in finger torque control in children with DCD persist as a function of age, rather than progressing or resolving.

Perceived competence, motor performance, and body mass index: A study of Brazilian children

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Obesity and physical inactivity in children are serious health concerns in contemporary society. To aid in understanding the problem, researchers have turned their attention to physical activity, body weight, and a variety of psychological, social, and behavioral factors. The present study examined the relationship between perceived physical competence (PPC), motor performance (MP) and Body Mass Index (BMI) in preschoolers. Our expectation was that children with higher BMI values would have lower PPC and MP scores than those representing the healthy weight category. We tested 189 children ages of 4 – 7 years (M_{age} = 5.44, SD = 1.07) representing eight public schools in Rio Grande do Sul, Brazil. Eighty-seven (46%) were boys and 102 (54%) were girls. We used the Test of Gross Motor Development-2 to assess MP and the Pictorial Scale of Perceived Competence and Social Acceptance to assess PPC. Height and weight values were used to determine BMI and classified according to CDC standards. By category, 3% were underweight, 60% healthy weight, 17% overweight, and 20% were obese. ANOVA results by BMI category revealed, as predicted, that obese children had significantly lower MP ($p < .05$) and PPC ($p < .05$) scores compared to healthy weight children. Among the multiple correlation results, the most noteworthy was a significant negative correlation between PPC and BMI (r = -.18, $p < .05$) and a significant negative correlation between MP and BMI (r = -.31, $p < .05$). Our discussion focuses on the influence of perceived competence on motor performance and body mass of young children—a factor that has significant implications for child health and psychological well-being.

Visual occlusion of the preferred arm in infants: effect on handedness and motor performance

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This study aimed at assessing the effect of visual occlusion of the preferred arm on frequency of use and motor performance of the preferred arm for manual reaching in 5-month-old infants ($n = 5$). Evaluations were performed on the task of reaching for toys at the midline position in the following situations: full vision before visual occlusion, at the end of each one of 7 periods of 1 min of visual occlusion of the preferred arm, and post-visual occlusion under full vision. Performance on reaching was evaluated through kinematics of the visually occluded arm. Results indicated that visual occlusion led to increased frequency of reaching with the nonpreferred visible arm during the occlusion period. Increased use of the nonpreferred arm was observed also in the post-visual occlusion period for some infants. Visual occlusion did not lead to variation of movement kinematics. These results suggest that visual contact with a given arm induces increased frequency of its use, which might affect the development of laterality during infancy.

Brazilian validation of MABC-2 checklist

Ramalho, Maria H.; State University of Santa Catarina; Valentini, Nadia C.; Federal University of Rio Grande do Sul; Muraro, Caren F.; Nobre, Glauber C.; Gadens, Ramona, State University of Santa Catarina; Oliveira, Marcio A.; University of Maryland

The Movement Assessment Battery for Children checklist second edition (MABC-2-Checklist) was primarily developed for screening children with motor difficulties, and to provide information about how they interact with objects and their living environment. Objective: To translate and verify: (1) face, content and construct validity, and the reliability of the Portuguese version of the MABC-2 Checklist; (2) to investigate the usefulness of the MABC-2-Checklist as a screening tool in Brazil. Methods: 47 professionals, 20 parents; and 532 children (girls: 276; boys: 256) between 5 and 12 years old participated in this study. Results: the translated version of the MABC-2-Checklist demonstrated convergent and discriminant validity (p values = 0.05); excellent internal consistency (all sections, $\alpha = 0.94$) and high indices of interevaluator reliability. Conclusion: the translated Portuguese version of the Checklist-MABC-2 showed great face, content and construct validity to be used in children from Brazil and to screen those with motor difficulties.

Assisted exercise improves cognitive and motor functions in persons with Down syndrome

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Current physical activity guidelines for persons with Down syndrome (DS) are often non-specific in terms of the type or intensity of exercise and results on motor and cognitive functioning are limited. This study investigated three interventions and their impact on cognitive and motor functions in adults with DS. Nine Persons with DS exercised on a stationary bicycle for 30 min in 3 interventions that were separated by at least 1 week (1) Voluntary cycling rate, in which participants cycled at their self-selected rate (2) Assisted

cycling rate, in which a motor moved the bicycle pedals at a rate at least 35% greater than their voluntary rate (3) Music listening, in which there was no exercise. The results showed improvements in manual motor function following Assisted exercise but not Voluntary exercise. More importantly, our results showed improvements in reaction time and cognitive planning only after the Assisted exercise intervention. In addition, exercise perception was better only after the Assisted exercise intervention. The fact that a lower leg exercise improved upper limb movement indicates that improvements are happening at the cortical level. Furthermore, our results of improved cognitive function after Assisted exercise in persons with DS is consistent with improved executive function as demonstrated by activation of the prefrontal cortex and amygdala as was found after Assisted exercise in Parkinson's patients (Alberts et al., 2011). It has been proposed that increased afferent information produced by the high pedaling rate of Assisted exercise paradigms produces molecular level changes at the cortical level, including up-regulation of the neurotrophic factors. Our results showed that the cadence for the Voluntary exercise group was 53 rpm, and for the Assisted exercise group was 81 rpm. Thus, when exercise cycling rate is fast cognitive and motor improvements can be found in adults with DS, even in a single exercise session.

The effect of school physical activity policy implementation on in-school physical activity

Robinson, Leah E.; Wadsworth, Danielle D.; Webster, Elizabeth K.; Daly, Colleen; Logan, Samuel W.; Gell, Nancy, Auburn University

Schools are implementing physical activity policies to combat the childhood obesity epidemic. This study investigated the role of state and school mandated physical activity policies on students' school-day physical activity behaviors in one school district in Alabama. 684 school-age children (343 girls) grades K – 5 from 5 elementary schools, served as participants. Physical activity behaviors during the school day were assessed with Omron HJ-720 ITC pedometers and semi-structured interviews were completed with school officials and teachers to ascertain the extent of physical activity opportunities and level of policy implementation. Descriptive mean findings indicate that average waist circumference was 67.46 + 12.82 cm. In terms of weight status, 27% of the children were classified as Obese, 16% as Overweight, 56% as Normal, and 1% Underweight. Step count results indicate that students accumulated an average of 9.75 and 8.29 steps/min for boys and girls, respectively, throughout the school day. School policies primarily reflected physical education (PE) requirements and written school policy did not differ between schools. School officials and teachers stated the importance of PE and physical activity during school hours, but all schools demonstrated limited or no physical activity opportunities before, during, or after school. Furthermore, school officials and teachers could not reiterate any of the school's physical activity policies, except for "students have to go to PE." Most schools did meet or exceed state PE requirements on their school schedule. However, over the course of the study, PE was canceled or shortened approximately 22% of the time due to assemblies, disciplinary actions, or other school activities. It appears that state mandated policies encourage schools to implement PE. However, the implementation of PE as the sole physical activity opportunity results in low steps/minute. Thus, it appears that schools must incorporate and implement policies that give children the opportunity to move and be physically active throughout the school day.

The end-state comfort effect with the overturned-glass task in school-age children

Robinson, Leah E; Fischman, Mark G.; Cole, Kayla; Lyon, Elizabeth, Auburn University; Cooper, Charles, Cary Woods Elementary School

The end-state comfort effect reflects the desire to minimize awkward hand and arm postures at the end of object manipulation tasks, rather than the beginning (Cohen & Rosenbaum, 2004). A popular task for studying the planning constraint of end-state comfort has been the overturned-glass task. In this ecologically relevant task, participants pick up an overturned glass from either a table or a shelf, turn it right side up, and then fill it with water. Adults consistently perform the task by grasping the glass with an awkward, pronated thumb-down grip, and then turn the glass upright by supinating the hand to finish in a comfortable thumb-up posture. Adalbjornsson et al. (2008) examined this task with preschoolers and kindergarteners, and found little evidence of sensitivity to end-state comfort. The purpose of this study was to examine cross-sectionally the end-state comfort effect in older children so that we might uncover any developmental trends in the emergence of this motor planning constraint. Participants were 243 children from grades 1 – 5 (114 girls; 129 boys). An overturned plastic drinking cup and a plastic measuring cup containing some water were placed on a table. While seated, each participant was given three trials to use one hand (child's preference) to turn the drinking cup upright and fill it with some water from the measuring cup. The end-state comfort effect was considered present if the awkward initial grip (thumb-down) appeared in all three trials. The percentage of boys who exhibited sensitivity to end-state comfort increased linearly across grades, ranging from 52% in grade 1 to 88% in grade 5. For the girls, however, we found a U-shaped function, where the percentages dropped from 75% in grade 1 to 59% in grade 3, and then increased to 77% and 75% in grades 4 and 5, respectively. These sex differences were unexpected and are worthy of further study. In general, sensitivity to end-state comfort for this task tended to increase across developmental time.

The relationship between motor skill proficiency, athletic identity, and physical activity levels among adolescents: A preliminary investigation

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Motor skill proficiency (MSP) and perception of identity as athletes (i.e., athletic identity—AI) among adolescents were investigated in light of decreasing participation in activity, particularly sport attrition among girls. The broader problem of obesity among children can perhaps be addressed by investigating motor development alongside psychological constructs that affect behavior. The association between athletic identity (AI) and physical activity levels (PA) is sufficiently supported (Anderson et al., 2009); however, the relationship of MSP to both constructs has not been fully established among adolescents. Children (Lubbock, TX; $N = 48$; $F = 23$, $M = 25$) between 11 and 14 years ($M = 12.2$, $SD = 0.92$) accomplished two questionnaires: Athletic Identity Measurement Scale (AIMS) and the Physical Activity Questionnaire, PAQ, Kowalski et al., 2004, to gauge AI and PA respectively. To assess MSP, the Movement Assessment Battery for Children - Second Edition (Henderson, Sugden, & Barnett, 2007) was administered. Separate analyses between genders reflected a clear dichotomy. For boys (range of $r = 0.55$ to 0.70), moderate to strong relationships were found between the three variables, whereas among girls, the only noteworthy association was between AI and PA ($r = 0.50$). Among girls, MSP had little to do with either PA ($r = 0.22$) or AI ($r = 0.08$): neither athletic "sense" or perception nor "involvement in activity" appear to be influenced by skillfulness. Instead, the association between AI and PA highlights the role of perceptions. For boys the moderate to strong associations between MSP,

AI, and PA suggest several paths toward achieving an active lifestyle. Skill levels (MSP) appear to be consistent with both perceptions (AI) and lifestyles (PA). Further analyses can identify which factor(s) fundamentally drives the relationships. Nevertheless, shaping perceptions (AI) can potentially encourage more girls or inactive adolescents (boys/girls) to participate in sport. Additionally, reciprocating influences between variables among boys, suggest greater malleability.

Contribution of trunk segments and muscle coordination to acquisition of upright control for independent sitting

Saavedra, Sandra; Woollacott, Marjorie; University of Oregon

Background: The question of how infants attain upright sitting is at the core of understanding the development of most functional abilities. Previous studies have considered the trunk to develop as a single segment. Our simple, practical method of securing the hips and different trunk segments while evaluating the infant's ability to vertically align and stabilize the head in space contributes a novel technique and new insights into the development of upright control. Objective: The goal of the current study was to examine how postural control changed across multiple trunk segments during typical development (TD) of sitting balance. Methods: We collected electromyography (EMG) and kinematic data with four levels of the trunk support (axillae, mid-ribs, waist, hips), in a longitudinal study of eight TD infants (3-9 months of age). Results: We found that developmental changes in head stability were specific to the region of the trunk being investigated. With support at the axillae or mid-ribs most developmental changes occurred for movements along the anterior-posterior (AP) axis. Most developmental changes occurred for movements along the medial lateral (ML) axis when support was provided at the waist. With hip support all parameters for AP and ML axes changed over time as infants gained trunk control for independent sitting. The relationship between muscle activation and movement changed from reactive responses, to proactive graded responses as infants developed upright control. Conclusions: The change from reactive responses to proactive responses demonstrates that infants must learn to anticipate the effects of gravity during acquisition of upright control. Researchers and clinicians can use this information to refine hypotheses regarding the development of trunk control and/or to develop and test more specific treatment programs for children with postural dysfunction. We are expanding the knowledge base by using this method to evaluate constraints on sitting balance in children with moderate-to-severe cerebral palsy.

Relation between level of trunk control and trunk inclination angle for optimizing step responses in infants supported on a motorized treadmill

Saavedra, Sandra; Ulrich, Beverly, University of Michigan

Background: Current therapies designed to help children with physical disabilities learn to walk are impractical for those with moderate-to-severe deficits. For example, bodyweight supported treadmill training, walkers, and robotic training require good trunk control, which these children do not have. Thus gait training is either inaccessible or inefficient for those children in greatest need. Researchers working with healthy infants (who have poor trunk control, naturally), tip babies' trunks forward when supporting them on treadmills to help them step. A specific angle of inclination has not, however, been proposed nor has the rationale for this posture been articulated or tested. Here we examined whether trunk inclination angle and/or infant's level of trunk control influence step responses in healthy

infants when supported on a treadmill. Methods: Using a trunk support device with adjustable forward inclination angle and pediatric motorized treadmill, we assessed monthly the steps produced by 7 infants during the age range when trunk control typically develops (1-7 months). Concurrent assessment of the segmental level of trunk control provided information necessary to test the relation between infants' level of trunk control, angle of inclination and step responses. Results: We found a non-significant effect of inclination angle, however, infants' level of trunk control correlated with step type. Alternating steps occurred predominantly in infants who had achieved trunk control through the lumbar spine and pelvis. Single step frequency showed an inverted U-shape pattern with the highest number occurring when infants' trunk control was in the mid- and lower-thoracic spine. Infants who had only cervical control took the fewest steps. Conclusions: A child's level of trunk control, rather than the type of assistive device may influence stepping responses. In future studies we will examine the effect of trunk inclination angle and trunk control on treadmill stepping responses in children with moderate-to-severe cerebral palsy.

Characteristics of old adults' self-estimation of their own ability in stepping over action

Sakurai, Ryota; Ishihara, Masami; Fujiwara, Yoshinori; Imanaka, Kuniyasu; Tokyo Metropolitan University

Accurate self-estimation (SE) of one's own physical ability (PA) is essential to successfully perform motor action. In contrast, failure in accurate SE should increase an action-related risk, leading to a possible severe accident particularly for old adults. We examined the characteristics of SE of PA in old adults compared with young adults, using a stepping over test (SOT). Both stepping over ability and SE of it were measured in SOT for both 97 old and 30 young adults. The subjects first observed a horizontal bar placed 1 or 7 m in front of them, with the height of the bar being manipulated in a descending/ascending direction; they then verbally reported the maximal height (estimated height, EH) of the bar at which they believed to successfully clear in stepping over action; and they were subsequently asked to point by the index finger on an adjacent panel board beside them the height which was perceived to correspond to EH (perceived EH, i.e., PEH, making judgment in the near space). Following this, the subjects performed a motor action of SOT at EH. When they failed/succeeded it, an extra trial was repeated at a lower/higher height until they succeeded/failed with a new height; and the final height was registered as the actual height (AH). Our results showed that all the young adults successfully stepped over the bar at EH (indicating an underestimation of PA), whereas almost 15% of the old adults failed it at EH (indicating an overestimation). Resulted differences for EH and AH showed a significant reverse correlation with AH, indicating that the degree of overestimation increased as the stepping over ability decreased. The PEH in turn showed a lower height than did EH for the old adults, indicating that they conservatively (i.e., with an underestimation/less overestimation) perceived their own EH when making judgments in the near-body space (PEH). In conclusion, the old adults' action-related SE (EH) of PA may be characterized by overestimation, although action-unrelated (i.e., performed in the near space) perception (PEH) is relatively normal.

Investigating the affordances of tool selection and tool use in typically developing children

Scharoun, Sara M.; Bryden, Pamela J.; Cinelli, Michael E.; Hackney, Amy L.; Wilfrid Laurier University; Gonzalez, Dave A.; Roy, Eric A.; University of Waterloo

Gibson's theory of affordances (Gibson, 1979) provides a foundation for the perception of an object in terms of its action. Objects such as tools, require distinct actions for use; therefore selection is likely to surround the presence (or absence) of physical characteristics that may promote (or impede) a movement. Developmentally, tool selection and tool use presents children with the opportunity to understand properties surrounding different tool-surface or tool-object combinations through trial and error (Lockman, 2000). The purpose of the current study was to investigate whether tool properties provide inherent information about their use and therefore influence typically developing children's tool selection in a particular task. Twenty-nine children ages 5 to 8 were asked to pick the best tool from peripersonal space to hammer a nail (selecting from a hammer, rock, wrench or comb) and dig sand in a bucket (selecting from a shovel, rake, wooden block or tweezers). Four trials were completed of each task, where task and tool location were randomized. Tool selection order was recorded using a video camera. Preliminary analysis revealed older children are more adept at perceiving inherent properties of a tool that afford completing the above-mentioned tasks. As such, 77.8% older children selected the hammer and, subsequently, the shovel to complete the tasks, in comparison to 57.3% of younger children. That being said, for the task that required hammering a nail, 19.6% of all children selected the rock first, thus implying children perceive inherent characteristics of the rock to also facilitate hammering. Similar age differences existed in children's perceptions of the worst tool's inherent properties, such that older children were most likely to choose the inappropriate tool (comb and tweezers) last to complete the above-mentioned tasks. Overall, children are better able to perceive inherent properties of the best tool, in comparison to the worst tool; therefore demonstrating children are able to perceive inherent characteristics of tools to afford action.

Motor control, motor planning, and the development of hand preference in typically developing children

Scharoun, Sara M.; Bryden, Pamela J.; Wilfrid Laurier University

Use of the preferred hand has been linked to enhanced motor performance; however, whether the preferred hand surpasses the non-preferred hand in motor planning remains inconclusive (Janssen, et al., 2011). End-state- comfort can be used to assess motor planning, defined as the tendency to assume comfortable postures at the end of simple object manipulation tasks rather than at the beginning. Concurrently, analysis can extend to include social interaction, such that adults consider the beginning-state comfort of another, without sacrificing their own end-state comfort (Gonzalez et al., 2011); however, there has been little research conducted to delineate trends in children. The purpose of the current study was to explore hand preference abilities as they pertain to motor control, motor planning and the development of children. Sixty-eight (51 right-handed and 17 left-handed) children (3-12 years old) completed the WatHand Cabinet Test (WHCT) and an End-State Comfort Test (ESCT). Participants were asked to pick up a cup and pour themselves a glass of water from a pitcher and to pick up a cup and pass it to the researcher to pour a glass of water for the participant. Cup placement altered between right-side up and inverted. The hand used to pick up and pass was recorded using a video camera. Videos were coded to note evidence of end-state comfort and beginning-state comfort. Preliminary analysis revealed hand preference does not influence the decision to pick up the cup; however, 7-12 year olds use their preferred hand to pick up the pitcher. When passing the cup, only 11-12 year olds use their preferred hand consistently. Regarding motor planning, similar to adults (Gonzalez et al., 2011), 9-12

year olds take into consideration the beginning-state comfort of another, without sacrificing their own end-state comfort. 3-8 year olds also consider the beginning state comfort of another, without taking into consideration their own end-state comfort. These results will be discussed in light of current theories of motor control and motor planning.

Post-stroke balance coordination is associated with quality of life

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Purpose: Balance coordination is a complex task requiring coordination of multiple body systems and structures. It is commonly impaired after stroke and is known to impact stroke recovery and rehabilitation potential. However, at this time the relationship between balance and quality of life (QoL) has yet to be established in the chronic stroke population. The purpose of this study was to examine this relationship. Methods: This was a cross-sectional study of people with chronic stroke who had completed rehabilitation, were 50-75 years old, and who passed a cognitive screen. We included the Berg Balance Scale (BBS) to measure static and dynamic balance coordination and the Stroke Specific QoL (SSQoL) to assess QoL. Higher scores indicate better balance or QoL, respectively. Clinically, those with BBS scores < 46 (out of 56) have been identified as having balance impairment and are at great risk for falls. We used Pearson correlations to assess the relationship between balance and QoL and independent *t*-tests to compare QoL scores between those with and without impaired balance. Results: The average age of the 59 participants was 64±9, 78% were male, and 31% were black. The mean scores (±*SD*) were 44 ± 8 on the BBS and 46 ± 8 on the SSQoL. The BBS and SSQoL scores were significantly correlated ($r = .394$, $p = .002$). Those with balance impairment (BBS < 46, $n = 29$, 49%) had an average BBS score of 39 ± 7 and significantly worse SSQoL scores than those without balance impairment (42 ± 8 vs. 49 ± 7, $p = .001$). Conclusion: In the chronic stroke population, balance impairment and fall risk are associated with worse QoL. Balance re-training is an important component of stroke rehabilitation and is included in published guidelines. However effective, evidence-based balance interventions have not been established for people in the chronic phases of stroke. If balance re-training interventions can be developed and implemented for people with chronic stroke, it is likely that balance can be improved and maintained into the chronic phases of stroke and individuals will benefit with improved QoL

Using high autonomy teaching in elementary physical education: An alternative approach to fitness units

Sluder, Brandon; Shaughnessy, Candice; Troy University

Evidence suggesting that physical activity can provide short- and long-term health benefits in youth is widely known (Biddle, Gorely, & Stensel, 2004; Trost & Pate, 1999). A long-standing goal of physical education is to improve children's fitness and health. School physical education programs may be the only institutions that provide all children opportunities to develop lifetime physical activity interests and patterns (Sallis & McKenzie, 1991). Studies have indicated physical activity patterns in adulthood are strongly correlated to physical activity habits established in childhood (Dennison, Straus, Mellits, & Charney, 1988). Some educators believe students should take responsibility in learning rather than the teacher directing all teaching and learning as seen in the direct teaching style. This view of a learning

centered curriculum moves the teacher off center stage and provides an opportunity for the students to help one another learn (Dyson, Griffin, & Hastie, 2004). Instructional models that promote high autonomy are ways to change the learning environment. The purpose of this study was to investigate changes in students' aerobic fitness levels following two high autonomy teaching interventions. Furthermore, the researchers sought to compare and contrast the two different types of high autonomy teaching interventions. The interventions under investigation were a high autonomy obstacle course fitness unit and a high autonomy running fitness unit. In both teaching units the students participated in teams learning about health-related fitness concepts, developing their own training programs, and competing in team challenges. Participants were 120 male and 120 female fifth-grade students from six elementary schools located in Alabama. Wallhead and O'Sullivan (2005) suggested student fitness may be difficult to achieve using high autonomy teaching models (Sport Education). However, like Hastie, Sluder, Buchanan, & Wadsworth (2009) the current study provides evidence to the contrary. Students participating in both high autonomy teaching units ran significantly more laps on the Progressive Aerobic Cardiovascular Endurance Run (PACER) than those in the control groups. The research suggests that high autonomy teaching models could be a better alternative than the traditional direct teaching approach when teaching fitness in elementary physical education.

An examination of the relative age effect in developmental girls' hockey in Ontario

Smith, Kristy L.; Weir, Patricia L.; University of Windsor

The relative age effect (RAE) suggests that athletes born earlier in a sport's selection year are provided with greater opportunities for athletic success. While the effect has been well established in men's sports, studies focused on female athletes have been lacking and have focused primarily on adolescent age groups (Cobley et al., 2009). In the past decade, the popularity of female ice hockey has increased dramatically and the sport is becoming more fully developed. While the first examination of Canadian female ice hockey players did not reveal the presence of a RAE (Wattie et al., 2007), a larger, more comprehensive study of national level women's ice hockey showed a higher percentage of players being born in the first six months of the year (Weir et al., 2010). The purpose of the present study was to take an exploratory look at the RAE in developmental girls' hockey in Ontario, using pre-adolescent, adolescent, and post-adolescent age groups to allow for an examination of the full range of physical maturation. Relative age, community location and size, player position, age division, and level of play information were provided by the O.W.H.A. for 36,555 registrants. Across all age divisions and levels of play there was an over-representation in the first and second quartile and an under-representation in the fourth quartile. This suggests that the RAE is present in developmental girls' hockey, the magnitude of which is moderated by level of play, player position, and community size. It is expected that the increasing popularity of women's hockey will result in the RAE becoming even more pronounced. This research was funded by the Social Sciences and Humanities Research Council.

Effect of practice with the nondominant hand on manual preference and performance: A developmental perspective

Souza, Rosana M.; Coelho, Daniel B., Teixeira, Luis; Federal University of São Carlos

This study aimed to evaluate the effect of lateralized practice with the nondominant hand on manual preference and performance in 8- to 10-year-olds and adults. Right-handed children

(n = 18) and adults (n = 18) were assigned to an experimental (practice) or control (rest) group. Experimental groups practiced several reaching, grasping and manipulative tasks using their left hand only. Practice was made during six sessions, twice a week. Probing tasks consisted of reaching and grasping cards positioned at distinct eccentricities in the right and left hemifields, then transporting and depositing the card on a table (simple task), or inserting the card into a slot (complex task). Manual preference was analyzed through frequency of hand use to perform the tasks. Performance was analyzed through movement kinematics. Manual preference and performance were evaluated before, immediately after practice and 20 days after practice. Results showed that left-handed practice led to increased preference of the left hand in adults for the simple task at the midline position. Lateralized practice led to a persistent increased preference of the left hand for both simple and complex tasks in ipsilateral positions in the children. Kinematic analysis indicated that lateralized practice induced increased movement straightness with the left hand in children, but no effect was detected in the adults. These results suggest that lateralized practice with the nondominant hand has a stronger effect on shift of manual preference in children than in adults, but shift of manual preference does not seem to be inextricably dependent on performance improvement with the nondominant hand at the practiced task.

Comparison of component developmental sequences and ball speed in overarm throwing

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This study examined how throwing component developmental sequences and thrown ball speed relate using a unique within-individual task progression that demanded sequential increases in systemic force output. 27 college aged (avg. age 21.4 years) adults (16 females and 11 males) threw tennis balls to a target at seven different distances of 15, 25, 35, 45, 55, 65 feet and maximum effort with five trials per level. Each progressive target distance demanded an increase in systemic energy output to be able to complete the task. Ball speed was measured using a radar gun (Stalker, Inc.). We compared component developmental sequence modes for step (4 levels), trunk (3 levels), humerus (3 levels), forearm (3 levels), the sum of all components and average ball speeds by gender. Spearman's rank order correlations compared the relationships among component levels and ball speed by gender. Results indicated that the increase in the task demands (i.e., distance thrown) promoted consistent increases in ball speed in both men and women. Changes in throwing component levels were strongly correlated to changes in ball speed in men (r = .67 - .87). Correlations in women were generally lower (r = .56 - .67). Correlations between the sum of component sequence levels and ball speed were stronger for both men (r = .93) and women (r = .73). As proposed by Stodden et al. (2006) increases in systemic energy demanded by increasing the distance thrown (i.e., increased effort) resulted in moderate to strong correlations between all component levels and ball speed and the sum of component levels and ball speed. The study protocol allowed for a better understanding of acute changes in both process- and product-oriented throwing performance that usually are demonstrated in cross-sectional or longitudinal study designs. Results of this study further delineate the relationship between process- and product-oriented overarm throwing performance and provide additional insight into the mechanisms underlying the development of skilled throwing.

The influence of gross motor skills on the development of gait in typically developing infants: A longitudinal pilot study

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Purpose: The purpose of this study was to identify the necessary gross motor skills required for gait acquisition in children. Methods: Eight infants participated in this descriptive longitudinal pilot study. This was a sample of convenience of typically developing children as per parent and physician report. Participation began at 6 months old and continued approximately once every 4 weeks until 6 months post 5 independent steps. Researchers facilitated play and exploration of the environment to include testing of all items of the Movement Assessment for Children (MAC). The MAC is an assessment tool for fine and gross motor function for children aged 2-24 months. Results: Four motor skills from the gross motor section of the MAC were examined in relation to ambulation. The motor skills included coming to sit (using rotation), cruising (quickly and easily), coming to stand (with LE separation), and progressing in prone (hands and knees with reciprocal movement). The average time to onset of walking after coming to sit was 4.1 ± 1.0 months, 2.4 ± 0.9 months to onset of walking after cruising, 2.8 ± 1.4 months to onset of walking after coming to stand, and 4.1 ± 1.0 months to onset of walking after progressing in prone. As this study uncovered one participant's gross motor skills appeared to be delayed when compared to norms, however, acquisition of the motor skills occurred within the same time frame in relation to walking as the other participants. Conclusion The average age of acquisition for a single motor milestone provides an idea of when a child is experiencing delayed motor development; however, looking at the movement pattern and timing of skill acquisition in relation to other motor milestones provides a more complete picture of motor development. A child may appear delayed when looking at individual motor milestones; however, a look at the relationship between the motor milestones may show us if there is truly atypical development. The temporal relationship between motor milestones appears to be more important than the inherent timeline of skill development.

The influence of the amount of teaching experience on nursery teachers' verbal responses to infants' exercise play

Tomomi, Yamaguchi; Hiroshi, Sekiya; Hiroshima University

This study examined the relationship between years of experience and verbal response of nursery teachers in exercise play. The behavior of five nursery teachers (age: 34.4 ± 10.6 years, years of nursery experience: 13.2 ± 9.2 years, teaching experience with 5-year-olds: 3.8±2.6 years) was videotaped when infants played a ball game. The verbal protocol of the infants and teachers was converted into text data. Teachers' verbal protocol was divided into separate units whenever infants talked back or there was a silent period. Verbal responses were placed into eight categories (repetition, expressing infant opinion, directive lead, non-directive lead, transmission of information, acceptance, explanation of situations and others). Teachers completed a questionnaire regarding years of experience as nursery teachers, teaching experience with 5-year-olds, years of teaching experience, exercise experience, and philosophy regarding nursing. Correlation analysis was used to investigate the relationship between years of nursery experience and the percentage of each category in the verbal protocols. A strong positive correlation ($r = .98$, $p < .01$) was found between the years of experience in teaching 5-year-old children and the percentage of non-directive lead, Suggesting that a nondirective verbal response, which is important for the development

of an infant's independence, can be acquired through practical experience. It is noteworthy that teaching experience with 5-year-old children, but not years of nursery experience, correlated positively with nondirective verbal response. It is, therefore, reasonable to say that experience in teaching 5- year-old children enables teachers to help children in that age group develop independence because such teachers can understand infant behavior. Therefore, the number of years of teaching older infants is an important factor to facilitate infant independence by using non-directive verbal instructions.

A cross-cultural analysis of Brazilian and American children using the movement assessment battery for children (MABC)

Valentini, Nadia C., Universidade Federal do Rio Grande do Sul; Oliveira, Marcio A., University of Maryland; Pangelinan, Melissa, University of Toronto; Whitall, Jill, University of Maryland; Clark, Jane E., University of Maryland

The prevalence of developmental coordination disorder (DCD) appears to be greater than the 5% to 6% originally stated by the APA (2000); recent estimates of DCD range from 8% to 19%. This raises several epidemiological concerns as well as the need to further explore the assessment of motor deficits in children. The Movement Assessment Battery for Children (MABC) is considered the gold- standard for the assessment of DCD. We developed a cross-cultural analysis of MABC scores from American and Brazilian children aged 4 to 12 years. Specifically, we aimed to: a) explore differences in the prevalence of motor impairment in the Brazilian and the United States (US) samples; b) examine the ability to discriminate and predict motor impairment using the MABC; and, c) identify the discriminating ability of each subtest of the MABC. A total of 1,055 motor impairment scores from children from the south of Brazil and Northeast of US were included. The prevalence within and across these two different populations was investigated with respect to the established cut-off points for the identification of at-risk (15%) and probable DCD (5%). The prevalence for at-risk and probable DCD was higher in Brazil as compared to children in the US. In addition, discriminant analyses were performed within each group. The discriminant functions were able to predict the group classification for typically developing (TD), at-risk and probable DCD. The MABC subtests analysis showed that the manual dexterity subcomponent was the strongest predictor and the ball skills subtest was the weakest predictor for both American and Brazilian children. Finally, the results showed that only TD children showed cultural differences in motor competence. These differences were not present in children classified at-risk or probable DCD. In sum, despite of the differences found in the prevalence of motor competence between groups, the cultural differences did not affect the overall discriminating validity of MABC in Brazil and the US.

The comparison of performance on two motor assessments in Brazilian children

Valentini, Nadia C.; Universidade Federal do Rio Grande do Sul; Logan, Samuel W.; Rudisill, Mary E.; Robinson, Leah E.; Auburn University

Accurate assessment of the motor domain is important to enable recommendations, follow-up assessments, and admission to compensatory programs. The Test of Gross Motor Development-2nd edition (TGMD-2) and the Movement Assessment Battery for Children (MABC) were each designed for similar purposes: screening for movement difficulties, assessment of an individual's progress, program evaluation, and as a research tool. The

purpose of this study is to determine whether or not each assessment measures the same construct of motor competence. This study compared performances on the TGMD-2 and MABC (N = 424; age range: 4-11 years). The TGMD-2 includes two subscales: object control and locomotor skills. The MABC includes three subscales: manual dexterity, ball skills, and balance. Performance on the MABC is classified as follows: < 5th% (indication of developmental coordination disorder [DCD]); > 5th to < 15th% (at risk for DCD); > 16th% (typically developing). Raw scores for each assessment were converted to percentile rankings. A Spearman ρ correlation indicated a significant relationship between the TGMD-2 and MABC percentiles (rs (424) = .37, p < .001). A related samples t test revealed a significant difference between mean percentiles of the TGMD-2 and MABC (p < .001). Crosstab analyses were calculated based on the 5th percentile criterion to determine the level of agreement between assessments to identify children with an indication of DCD. Results indicate that both assessments agreed on 95 out of 114 possible children as at risk of DCD. Although significant, the correlation between performance on the TGMD-2 and MABC is low and explained only 13.7% of the variance. Children scored significantly higher on the MABC (M percentile = 27.6) compared to the TGMD-2 (M percentile = 7.4) indicating that each assessment measures a different aspect of the motor domain. However, there was a high level of agreement between the assessments to identify children with an indication of DCD according to the criterion (< 5th%) established by performance on the MABC.

Brazilian validation of the Movement Assessment Battery for Children–second edition

Valentini, Nadia, Universidade Federal do Rio Grande do Sul; Ramalho, Maria H., State University of Santa Catarina; Oliveira, Marcio A., University of Maryland; Coutinho, Monia T., Federal University of Rio Grande do Sul

The Movement Assessment Battery for Children 2nd edition (MABC-2) is a well-recognized motor assessment tool used to identify children with developmental coordination disorder (DCD) across the world, including in Brazil. However, the MABC-2 has not yet been validated for the Brazilian population. In this study, we translated and validated all MABC-2 items with respect to content, construct, and criteria validity. We used a cross-cultural translation to obtain the Brazilian-Portuguese version of the MABC-2 (MABC-2br). The test validation process involved 13 developmental researchers and 844 children (from 3 to 13 years old) from different states in Brazil. The cross-cultural translation confirmed language clarity and pertinence. Intra- and inter-rater reliability showed high values for the test impairment scores (Intra-class Correlation Coefficient, ICC > .86), and acceptable values for the subtest's scores (> .71). Temporal stability was confirmed for the impairment scores and percentiles (ICC values > .82; correlation values > .52), as well as the subtest scores and percentiles (ICC values > .59; correlation values > .69). Adequate internal consistency for impairment scores, subtests, and percentiles (α values ranged between .52 to .81) was found. The discriminant analysis confirmed that the MABC-2br had the power (.80) to discriminate between children with DCD, children at risk for DCD from the typically developing children. Moreover, there were significant difference among the scores from the different groups of children (p values < .0001) and significant correlations between impairment scores and percentiles (DCD .60, at risk .28 and, TD .98; p values < .006). Predictive validity was observed for impairment scores and percentiles (ICC .93 and .73 respectively), and main effect was found for the ANOVA with repeated measure (p > .05). In sum, the MABC-2br showed adequate validity and reliability for Brazilian

children. We concluded that the original standardized scores established for the MABC-2 are valid to be used in the Brazilian population.

Effect of a youth-sport intervention program on motor skill development: An intra- and inter-cultural analysis

Valentini, Nadia C., Universidade Federal do Rio Grande do Sul; Kim, Min Joo, University of Maryland; Kim, Seonjin, Seoul National University; Rudisill, Mary E., Auburn University

Although sport oriented intervention programs vary across cultures, the ultimate goal includes motor skillfulness. In this study, we performed an intra- and inter-cultural analysis on the effects of a youth-sport intervention program on motor skill development in children from South Korean and Brazil. Motor Performance of forty-one children from Brazil (ages 4 to 11 years), and forty- one children from South Korean (ages 5 to 10) was assessed prior and after the one-year sport-oriented intervention period. Both interventions were implemented based on the following criteria: a) emphasis on the practice of gross motor skills, b) implementation of developmental appropriated tasks, c) similar number of lessons, and period of intervention. The intra and inter- cultural analysis was based on motor performance scores (pre- and post test) obtained by the Test of Gross Motor Development (TGMD-2; Ulrich, 2000). Overall the results showed that all children improved their locomotor (F (1, 76) = 17.70, $p < .0001$, $\chi^2 = .19$) and object control (F (1, 76) = 19.62, $p < .0001$, $\chi^2 = .20$) skills. Similar motor improvements were observed between boys and girls (p values > .05). The intra-cultural analysis showed a ceiling effect for the hoping ($p = .09$, 2.07) and sliding (.09, 2.07) skills only for South-Korean children. The intra-cultural analysis demonstrated a dramatic improvement on striking, running and throwing skills (p values $p < .0001$; χ^2 values of .45, .43 and .40 respectively) for the Brazilian children; whereas South Korean children showed major improvements on leaping, throwing, and dribbling skills (p values < .0001; χ^2 values of .37, .35, .32, respectively). We concluded that regardless of cultural differences, children can benefit from sport oriented interventions, which has shown effective to motor skill development.

Age-related differences in learning a gross motor sequence

Valentini, Nadia C., Federal University of Rio Grande do Sul; Du, Yue, University of Maryland, College Park; Kim, Min Joo, Seoul National University; Whitall, Jill, University of Maryland, Baltimore; Clark, Jane E., University of Maryland, College Park

One of the most studied sequence learning tasks in the literature is the serial reaction time task in which a sequence of target lights signals a finger pressing sequence (Nissen & Bullemer, 1987). Very little research, however, has examined the serial sequence task using a gross motor task even though such tasks are abundant in everyday life. Here we report our findings for a study exploring the developmental landscape for gross motor sequence learning. Participants were young adults (n = 10, M = 19.9 years), 10-year-olds (n = 12, M = 9.9 years) and 6-year-olds (n = 10; M = 6.2 years). Participants were visually presented a sequence to which they were to respond by stepping to one of 6 blocks positioned to the front, side or back. A 10-element sequence was repeated 10 times in a block and participants practiced four blocks before a novel sequence block was introduced. Data were collected with a motion capture system and foot reaction times (RT) were derived using a custom Matlab program. Unsurprisingly, a two-way ANOVA with repeated measure

showed a group main effect for RT [$F(2,78) = 21.7$, $p < 0.01$]. Specifically, adults performed better than both children's groups and 10-year-olds performed better than 6- year-olds. Compared to block one, all groups decreased their RT in block four ($p < 0.01$). When the novel sequence was introduced (following block 4) all age groups' RT increased suggesting that even 6-year-olds learned the sequence. A post training survey revealed that all adults and 10-year-olds reported recognizing there might be a sequence, but only 60% of the 6-year-olds indicated such and their ability to recall elements was poor. The survey data suggest that adults and perhaps 10-year-olds were likely to utilize explicit knowledge of the sequence whereas the younger children were dependent on implicit learning. These data provide support for implicit gross motor sequence learning by young children, but raise future questions about the developmental nature of sequence learning in tasks that are biomechanically more complex.

The influence of juggling on mental rotation performance in children with spina bifida

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Introduction Wiedenbauer and Jansen (2006) showed that children with spina bifida, a neural tube defect, have significant poorer spatial abilities, especially mental rotation abilities, compared to healthy children. Further, it was shown that adults as well as healthy children can improve their mental rotation ability with juggling training (Jansen, Titze & Heil, 2009). It was the aim of this study to investigate the effects of juggling training on mental rotation ability in children with spina bifida. Method Two groups of children with spina bifida (mean age: intervention 9,8; control 9,7) first performed a chronometric mental rotation test on a computer. In this test the children had to judge as quickly and as accurately as possible whether two rotated cube figures were the same or mirror reversed. Subsequently the intervention group participated in juggling training for one hour a week over a period of eight weeks. The control group had no special training. After eight weeks all children solved the chronometric computer test again. Reaction time and error rate between pre- and posttest were measured. Results The analysis of variance with repeated measurements showed a main effect for angular disparity ($F(2,34) = 138{,}426$, $p < .05$) and interactions between: time and group ($F(1,34) = 6{,}102$, $p < .01$) and angular disparity, time, and group ($F(2,34) = 4{,}751$, $p < .05$). The intervention group showed faster reaction times in the 90° and 180° condition, whereas the control group showed no improvement. Further a significant interaction effect for error rate was found ($F(1,34) = 6{,}085$, $p < .05$), with less errors in the posttest for the intervention group but not in pretest. Discussion Children with spina bifida improved their mental rotation ability with juggling training. This is in line with a study with healthy children (Jansen, Lang, & Heil, 2011). Since it was shown that poorer spatial abilities in children with spina bifida can be improved with a juggling training, this training should be considered in the therapy of those children.

Upright cycling performances in young children with cerebral palsy

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Stationary cycling is a common form of therapy in children with cerebral palsy (CP). These children may cycle earlier than they walk as stationary cycling is less demanding on balance control. Cycling is also a chance for them to be mobile and to engage in physical exercise. CP induces change in locomotor patterns; some of these changes may lead to secondary disability, due to the repetitive cycling motion in combination with excessive stress in the

joints. In this study we describe cycling kinematics and kinetics in young children with CP, preliminary to evaluating the consequences in a computer simulation. Two children with spastic hemiplegia (5 and 7 years of age, 15.9 and 33.1 kg, respectively) and two age-matched children without a CP diagnosis (N-CP) (18.1 and 29.0 kg, respectively) were included. Participants were asked to pedal at 40 and 60 RPM at a moderate resistance. Kinematic analyses revealed greater plantar flexion for both cadences compared to N-CP, especially on the affected side (pedaling in a toe-down position). Children with CP showed more knee flexion and hip internal rotation and adduction (scissoring). Kinetic analyses showed the children with CP pushed earlier in the downward phase and began pulling up on the pedal before the pedal reached bottom dead center (BDC). Pulling on the pedal before BDC means that the other leg has to pull harder during recovery to compensate for loss of propulsion. The important connection made in this study is the determination of the differences in forces applied to the pedal between CP and N-CP, despite both groups accomplishing the task goal (RPM). We have connected kinematic differences to differences in the pedal forces associated with the task. It is the repetitive, cycling application of force that has the potential to induce secondary disability. The data in this study will be used in the development of a computer simulation to evaluate the potential for injury or modification of the cycling task.

Effect of classroom-based physical activity breaks on physical activity and on-task behavior in preschool children

Wadsworth, Danielle D.; Robinson, Leah E.; Webster, Elizabeth K.; Logan, Samuel W.; Barber, Laura T.; Daly, Colleen; Auburn University

Physical activity (PA) behaviors are established in childhood and remain relatively consistent through adolescence and into adulthood, thus, it is important to promote PA in young children. The purpose of this study was to determine the effect of classroom PA breaks on moderate-to-vigorous physical activity (MVPA) and on-task behavior in preschool children. In addition, the study examined the relationship between motor skill competence and MVPA during the breaks. Children enrolled in a public, financially subsidized childcare center (n = 9) and a private, university-based childcare center (n = 12) participated in this within-subjects study. Data were collected on two days of typical instruction and two days that included the implementation of a 10-minute PA break. MVPA was measured with Actical accelerometers and gross motor skills were assessed with the Test of Gross Motor Development 2nd Ed. (TGMD-2). Children's on-task behavior was observed and recorded as on-task or off-task (motor, noise or passive/other). Paired-samples t tests indicated that preschoolers in each sample accumulated significantly more MVPA during the school day ($p < .0125$) and more MVPA indoors ($p < .0125$) on days that provided a physical activity break. There was a non-significant Spearman ρ correlation between TGMD-2 percentile score and minutes spent in MVPA during the physical activity breaks (rs (20) = .06, p = .787). Thus, children's level of motor skill competence did not affect their participation in physical activity. On-task behavior increased after the PA break, indicating that MVPA facilitated academic engagement and children were able to transition from the break to academic instruction. Providing classroom-based physical activity breaks in preschool settings is an effective strategy to increase PA participation and on-task behavior in young children, regardless of motor skill competence. Preschoolers' physical activity participation would benefit from policies or curriculum that aim to incorporate daily PA breaks.

Long-range correlations in young, healthy gait: Trial-to-trial consistency and influence of sample frequency

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Detrended fluctuation analysis (DFA) shows the stride-to-stride intervals exhibited by young, healthy individuals during gait reveal long-range correlations. However, it is unclear whether similar patterns emerge in continuous data (e.g., knee angle trajectory). Further, the ability of DFA to consistently index gait dynamics between trials and at different sample frequencies has yet to be determined. This study examined whether young, healthy individuals exhibit similar dynamics between trials and at different sample frequencies in both continuous and interval data. Participants ($N = 11$; age = 26.9 ± 4.9 years) performed three consecutive 15-min walking trials (two sampled at 100 Hz; one sampled at 1000 Hz; randomized order) on a treadmill at their preferred speed ($M = 1.26 \pm 0.16$ m/s). Continuous data (knee angle trajectory) was recorded and reduced to interval data by calculating the time between knee flexion initiation for each stride. The DFA scaling exponent (a) quantified the strength of the long-range correlations in the continuous and interval data. A 2×2 (data type $\times$ trial) ANOVA examined trial-to-trail consistency in the 100 Hz trials and revealed a main effect for data type ($F1,10 = 51.3$, $p < .001$), with the continuous data ($M = 0.56 \pm 0.03$) exhibiting lower values than the interval data (0.73 ± 0.08). A trial main effect was not observed ($p > .05$). A 2×2 (data type $\times$ sample frequency) ANOVA revealed an interaction ($F1,10 = 18.3$, $p < .001$). Follow-up protected t tests showed the 100 Hz continuous data exhibited lower values ($M = 0.56 \pm 0.03$) than the 100 Hz and 1000 Hz interval data ($M = 0.73 \pm 0.10$ and $M = 0.74 \pm 0.07$, respectively) and the 1000 Hz continuous data ($M = 0.67 \pm 0.02$). Collectively, the data shows that DFA is consistent between trials when sampled at the same frequency. When sampling continuous data at 100 Hz, the long-range correlations are lost, indicating that lower sample frequencies in continuous data may lack information about the moment-to-moment changes in the knee joint trajectory that reflects the control process.

Bone mineral content and density in preadolescent boys with and without Down syndrome

Wu, Jianhua (Jerry), Georgia State University

This study aimed to assess bone mineral content (BMC) and bone mineral density (BMD) in preadolescent white boys with and without Down syndrome (DS) at 7-10 years of age. Eight boys with DS and eight boys with typical development (TD) participated in this study. Dual-energy X-ray absorptiometry (DXA) was used to measure total body and lumbar spine BMC and BMD. Total body less head (TBLH) and lumbar spine BMC and BMD were compared between the DS and the TD groups, with and without adjusting for physical characteristics such as age, height, bone area, and total lean mass. Two bone mineral apparent density (BMAD) variables were calculated to estimate volumetric BMD at the lumbar spine. A series of t test were conducted on each dependent variable without adjusting physical characteristics. A series of 1-way (2 Group) ANCOVA with physical characteristics as covariates were conducted on TBLH and lumbar spine BMC and BMD. Significance level was set at $p < 0.05$. Results showed that there was no significant difference in total body and lumbar spine BMC and BMD, with and without adjusting physical characteristics between the DS and the TD groups. There was no significant difference in BMADs at the

lumbar spine between the two groups. These findings suggest that bone mineral accrual in preadolescent white boys with DS may be comparable to that in preadolescent boys with TD. It implies that significantly lower BMC and BMD in total body and at the lumbar spine may start to occur during the adolescent period in persons with DS.

Kinetic pattern of treadmill walking with ankle load in typically developing children

Wu, Jianhua (Jerry), Georgia State University

This study aimed to investigate how children kinetically adapt to ankle load during treadmill walking. Eight white boys with typical development at 7-10 years of age participated in this study. Testing conditions included two treadmill speeds and three ankle loads. Two treadmill speeds were 75% and 100% of their preferred overground walking speed. Three ankle loads were no load, 2%, and 4% of the participant's body weight. A total of six conditions were tested and two one-minute trials were collected for each condition. An instrumented treadmill was used to collect the vertical ground reaction force. Two peak forces were identified from force profile over the stance phase: the first after heel strike (P1) and the second before toe off (P2). Timing (in percentage of stance phase) and magnitude (in body weight) of P1 and P2 were analyzed. Rate of loading (VP1) and unloading (VP2) were calculated for the two peak forces, respectively. Data from the right side were presented. A series of 2 (speed) × 3 (ankle load) ANOVA with repeated measures were conducted on each dependent variable. Significance level was set at $p < 0.05$. Results showed that both peak forces P1 and P2 significantly increased the magnitude with treadmill speed and ankle load. Timing of P1 significantly decreased while timing of P2 increased with treadmill speed. However, timing of P1 was not affected by ankle load while timing of P2 significantly increased with ankle load. Loading rate VP1 significantly increased with treadmill speed but not with ankle load. Unloading rate VP2 significantly increased with both treadmill speed and ankle load. These results demonstrate that ankle load increases the magnitude of the two peak forces at the stance phase, but only increases the timing of P2 and the unloading rate.

Effect of ankle load and walking speed on kinetic pattern of treadmill walking in children with and without Down syndrome

Wu, Jianhua (Jerry), Georgia State University

This study aimed to investigate the kinetic pattern of treadmill walking in children with and without Down syndrome (DS). Eight white boys with typical development (TD) and eight with DS at 7-10 years of age participated in this study. Participants walked without ankle load at 75% and 100% of their preferred overground speed. Participants also walked with ankle load equal to 2% of the participant's body weight at 75% of their preferred overground speed. Two 1-min trials were collected for each condition. An instrumented treadmill was used to collect the vertical ground reaction force. Two peak forces were identified from force profile over the stance phase: the first after heel strike (P1) and the second before toe off (P2). Timing (in percentage of stance phase) and magnitude (in body weight) of P1 and P2 were analyzed. Rate of loading (VP1) and unloading (VP2) were calculated for the two peak forces, respectively. Data from the right side were presented. A series of 2-way ANOVA with repeated measures were conducted on each dependent variable. Significance level was set at $p < 0.05$. Results showed that while walking at 75% of the preferred overground speed with and without ankle load, the DS group had a significantly higher timing

of P1 and a lower timing of P2 than the TD group. While the magnitude of P1 and loading rate VP1 were not significantly different between the two groups, the DS group had a significantly lower magnitude of P2 and a lower unloading rate VP2 than the TD group. In addition, ankle load significantly increased both magnitude of P2 and loading rate VP2 for both groups. While walking without ankle load at the two treadmill speeds, the DS group produced the significantly lower magnitude and timing of P2 and unloading rate VP2 than the TD group. No significant difference was found in the magnitude and timing of P1 and loading rate VP1 between the two groups. These results indicate that both ankle load and treadmill speed elicit the differences between the DS and the TD groups in the magnitude and timing of P2 and unloading rate VP2.

Sitting postural sway enhances reaching in infancy

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Being able to sit upright opens up opportunities for infants to interact with their environment (e.g., reach for toys). Coordination of the postural system is important in the developmental course for infants as they acquire sitting skills. However, it is unclear whether infants decide to reach or not to reach based on the information obtained from the postural dynamics. We investigated the role of postural sway in the performance of reaching while seated in infants with moderate Cerebral Palsy who just achieved the motor milestone of independent sitting. Center of pressure (COP) data was collect as infants sat on the force platform in a natural play environment, in which the experimenter showed the infants toys at infants' eye level. Two events were indentified from the video recording: (1) reaching event, when infants were looking at the shown object and reached for it, and (2) non-reaching event, when infants were looking at the shown object but never reached for it. Postural measures derived from COP data (sampled at 200 Hz) were computed from a 2-s window preceding each event: root-mean-square (RMS) and range in both anteroposterior (AP) and mediolateral (ML) directions, and sway path of COP trajectory. Postural signatures in ML direction, including RMS and range, significantly differed between the contexts of reaching and non-reaching. When compared to the non-reaching context, the postural variability in ML direction is higher right before the onset of reaching (RMS: $p = .019$; range: $p = .031$). No significant effect was found in AP direction. Two interpretations can be drawn here: (1) infants are able to prospectively adjust their posture to support the upcoming reaching event as they master the skill to sit independently; and (2) infants are aware that self-controlled bodily movement provides essential information about their opportunity for reaching. Future study is needed to determine whether this difference in postural dynamics stems from the development of exploratory movement by altering the affordances (e.g., manipulate the distance of the object).

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Sport and Exercise Psychology*

The role of self-efficacy in reducing sedentary behavior: Implications for interventions

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Sedentary behavior (SB) is emerging as an independent risk factor for cardiovascular disease and type 2 diabetes (Katzmarzyk, 2010, Owen, et al., 2010), and as a target for physical activity and health promotion interventions. This study examined effects of an intervention based in Social Cognitive Theory to increase self-efficacy (SE) for reducing SB and increasing physical activity (PA). Women (mean age = 58.5 ± 12.5 years) from seven weight loss support clubs were enrolled in a 6-week intervention (n = 40) or wait-listed (n = 24) based on club randomization. The intervention, delivered via group sessions and email, used mastery feedback to reduce SB and increase steps. PA and SB were measured by accelerometers and self-report pre-post. SE (to reduce SB, to increase light and moderate PA) was measured pre, mid, and post. Repeated-measures MANOVA found no significant change over time or group × time interaction for behavior. The multivariate group and interaction effects for SE were non-significant, but a trend for time (p = .056) was noted. All three SE measures decreased from baseline to mid and rebounded at post, but the patterns varied. Univariate tests for SE to reduce SB, the main target variable, were significant for time (F = 3.34, $p < .05$) and the group × time interaction approached significance. SE decreased at mid-point, but increased at post for the intervention group while the WC group continued to fall. SE for LPA and MPA patterns were similar for both groups. Participant ratings and open-ended survey responses point to limited use of behavioral cues and modeling, and to environmental influences on participants' sedentary behavior. Barriers to self-monitoring SB included recall, routine, and time. Participants were receptive to monitoring PA via pedometer and rated step-counting as the most effective aspect of the intervention. The role of SE in changing SB needs further study. Interventions aimed at reducing SB should focus on behaviors that are easily monitored, such as steps, and should consider modifying the built environment as a way to build mastery.

The relationship between perfectionism and exercise dependence in regular exerciser: A mediating effect of self-determined motivation

Albert, Donald D.; Lu, Frank; National Taiwan Sport University

Increased attention has been paid to the idea that exercise can become a compulsive behavior, with suggestions that its use can become addictive based on the reasons for participation. It has been stressed that studying the correlates of exercise dependence is important because of its negative psychological and physical effects. Perfectionism, as indicated by previous

*The abstracts are alphabetically arranged by the first author's surname within each of the three sections—Motor Learning and Control, Developmental Perspectives: Motor Control/Coordination/Rehabilitation, and Sport and Exercise Psychology.

research, may be an important antecedent of exercise dependence (Hagan, A.L., & Hausenblas, H.A., 2003), but to date, few studies have sought to examine the psychological processes that underpin that relationship. The purpose of this study was to examine the mediating effect of self-determined motivation in the relationship between perfectionism and exercise dependence. Participants were 310 regular exercisers completed self-reported measures of their exercise behavior, perfectionism, and exercise dependence symptoms. Structural equation modeling provides support for the following hypotheses. Firstly, that both self-oriented and socially prescribed perfectionism are positively associated with exercise dependence. Secondly, self-oriented perfectionism is positively associated with self-determined motivation while negatively associated with non-self-determined forms of motivation. Thirdly, socially prescribed perfectionism is positively associated with non-self-determined forms of motivation and is negatively associated with self-determined motivation. Lastly, self-determined motivation was expected to mediate the relationship between perfectionism exercise dependence. The findings of study indicate that both self-oriented and socially prescribed perfectionism may be critical antecedents of exercise dependence, but that the psychological mechanisms underpinning their association with exercise dependence may differ. This research contributes to the growing body of evidence that has found exercise dependence to be underpinned by both unidimensional and multidimensional forms of perfectionism (Hagan & Hausenblas, 2003).

The role of satisfaction in the transformational leadership and performance relationship: Depends on the nature of satisfaction

Arthur, Calum; Smith, Matthew; University of Chichester

Whilst positive relationships between transformational leadership and outcomes such as group cohesion (Callow, Smith, Hardy, Arthur, & Hardy, 2009) and extra effort (Arthur, Woodman, Ong, & Hardy, 2010) have been demonstrated in sport, no research has examined transformational leaderships' effect on performance in sport. To this end the current study examined the transformational leadership and performance relationship. Furthermore, the mediating role of satisfaction was also explored. Adopting Hardy et al.'s (2010) conceptualization of transformational leadership and Riemer and Chelladurai's (1998) conceptualization of satisfaction we hypothesized that the relationship between appropriate role modeling (ARM) and performance will be mediated by performance related satisfaction (i.e., satisfaction with individual performance [SIP] and satisfaction with ability utilization [SAU]) but will not be mediated by satisfaction with ethics (SE). 179 ultimate frisbee players in 43 teams completed the DTLI, one week later completed the ASQ, and performance was rated by the coach. Controlling for the nested nature of the data the asymptotic within-teams covariance matrix, SW was analyzed using MPlus. Multiple mediator structural equation model revealed a significant direct effect for ARM on performance (B = .27(*SE* = .07), $p < .01$). ARM also predicted all of the satisfaction variables; SIP (B = .85(*SE* = .046), $p < .01$), SAU (B = .77(*SE* = .04), $p < .01$), and SE (B = .56(*SE* = .06), $p < .01$). Confirming the hypothesis significant indirect effects were obtained for SIP (B = .21(*SE* = .07), $p < .01$) and SAU (B = .23(*SE* = .06), $p < .01$) but non-significant indirect effect for SE (B = -.02(*SE* = .04), $p > .05$). The results indicate that transformational leadership predicted performance, satisfaction with ethics and satisfaction with performance; however, satisfaction with ethics did not mediate the transformational leadership and performance relationship. The results reveal that the nature of satisfaction determines whether satisfaction acts as a mediator between transformational leadership and performance.

Exploration of children's school- and home-based physical activity correlates: An expectancy-value theory approach

Babkes Stellino, Megan, University of Northern Colorado; Erwin, Heather, University of Kentucky; Beighle, Aaron, University of Kentucky

Evidence exists for the relationship between low levels of physical activity and overweight and obesity among children. Physical activity (PA) opportunities are available for most children during typical days in school, and at home, thereby potentially reducing the incidence of detrimental weight status. Social psychological factors, however, have the propensity to impact children's PA in these domains. Little research has examined theoretically based variables associated with children's PA both during, and outside of, school. Expectancy-value theory (EVT: Eccles et al., 1983) provides a useful framework to research how significant socializers, such as parents' and teachers' beliefs associated with PA, relate to children's own attitudes about, and actual, PA. Examination of the relationships between children's attraction to physical activity (CAPA), their perceptions of significant domain-relevant adults' expectations and values for them to be physically active, and their own levels of PA in various settings may yield important information for improvement of PA promotion efforts. The purpose of this study was to explore correlates of children's school- and home-based PA levels using an EVT approach. Elementary school children ($N = 226$; 47.3% male; M age = 10.22 years) completed measures of CAPA (Brustad, 1993) and perceived teacher, mother, father and self-reported expectations and values for PA based on EVT tenets. Children wore pedometers during the school day and at-home for non-school hours during four consecutive days as well as one weekend in order to obtain data on actual PA behavior. Correlational analyses indicated that greater amounts of school PA were significantly related to higher perceived teacher value and expectations for PA, CAPA, perceived mother value and children's own expectations for PA. Weekend PA was significantly associated with perceived parental expectations for PA and CAPA. Findings provide some support for EVT and offer insight on possible social psychological predictors of children's PA levels across settings.

Integrating proximate and ultimate explanations in sport and exercise psychology

Balish, Shea; Eys, Mark; Wilfrid Laurier; Schulte-Hostedde, Albrecht, Laurentian University

While sport and exercise psychology continue to mature, the discipline of psychology is undergoing a paradigm shift brought about by evolutionary psychology, an approach built upon the fact that mental architecture—the physiological, neurological, and psychological mechanisms that enable learning and produce human behavior—was designed by the same process as the architecture of the body, evolution via natural selection (Tooby & Cosmides, 1992). The insights of evolutionary psychology offer sport and exercise psychology an improved capacity to produce proximate explanations—how psychological mechanisms interact with the environment to produce behavior—by generating rich hypotheses from ultimate explanations—why a psychological mechanism evolved a particular design (Barkow, Tooby, & Cosmides, 1992). On this view, it is hypothesized that the mind, like the body, is highly modular, comprised of many domain-specific psychological mechanisms that evolved for solving specific adaptive problems recurrently encountered in the ancestral past. Evolutionary psychology rejects outdated dichotomies such as "nature versus nurture," "biology versus culture," "learned versus innate," enabling a genuinely interdisciplinary sport and exercise psychology. To demonstrate how integrating ultimate explanations will benefit sport and exercise psychology we outline how popular avenues of research benefit from evolutionary psychology. Specifically, (1) the interrelation between motivation and intention and their

relative influence on exercise behavior, (2) gender differences in sport participation, and (3) skill acquisition and performance. Unlike specific fields of psychology, evolutionary psychology is a metatherotical approach that can foster mutually productive linkages between currently disparate areas of sport and exercise psychology, and with neighboring disciplines. Although largely atomistic, evolutionary psychology strengthens multi-level models and makes predictions of how behavior should be distributed cross-culturally.

Feedback for coaches: Exploring intercollegiate coaches' perceptions of evaluation criteria and perceived control of the evaluation process

Barber, Heather, University of New Hampshire

Research has demonstrated that coaches' feedback influences self-perceptions of athletes (see Horn, 2008); however, little is known about the role of feedback and evaluation on coaches' self-perceptions and beliefs. Myers, Vargas-Tonsing, and Feltz (2005) identified feedback from athletic administrators as an important source of information, yet we know little about this process. This study examined intercollegiate coaches' perceptions of the evaluation process and perceived control over the outcome of evaluation. Male and female coaches ($N = 354$) from NCAA Division I, II, and III programs completed the Coaching Evaluation Inventory (CEI). The CEI focuses on coaches' perceptions of evaluation criteria and includes 52 items (13 criteria, 4 items each) used in the evaluation of coaches. Principal components factor analysis was conducted on these items. Six factors emerged: ability to develop and motivate athletes in practices and contests, support of the student-athlete model, winning/program success, public presence, fundraising, and communication/relationship with athletes. An examination of the means indicated that support of the student-athlete model, communication/relationship with athletes, and winning/program success were perceived to be the most important factors. MANOVAs examining gender and divisional differences found no gender differences in the perceived importance of these factors. Divisional differences in perceptions did exist in expected directions with greater importance being placed on winning/program success, fundraising and public presence by Division I coaches. MANOVA also was conducted on coaches' perceptions of control in their evaluation. Wilks's lambda = .87, $F(12, 556) = 3.43$, $p < .01$. Post hoc tests indicated that coaches who perceived low levels of control rated the importance of all the factors lower than those with higher perceptions of control with the exception of winning/program success. This suggests that individuals with higher levels of perceived control place importance on a broader set of criteria than merely winning/program success.

The effects of exergaming and traditional college physical activity on measures of cardiovascular fitness and cognitive function

Barella, Lisa A.; Meyler, Timothy; Beam, Stacey, Coastal Carolina University

Interactive video gaming is a tool that may be integrated into physical activity programs as a practical solution to combat sedentary behaviors. However, the effects of participating in exergaming on cardiovascular fitness are not well understood. Further, although video game playing is positively correlated with improved performance in executive control tasks by older adults and children, this relationship has not been tested in young, healthy adults. The purpose of this research was to compare the effects of a 7-week exergaming activity program with a 7-week "traditional" physical activity (PA) program on cardiovascular fitness and cognition. Participants in both programs participated in 150 min/week of activity. Cardiovascular fitness data (predicted VO_2max), cognitive function data (Trail Making Cost, PASAT, Stroop Interference), and self-reported health information (frequency of exercise,

amount of PA, number of vigorous bouts of PA, perceived health) were collected pre- and post-intervention on students enrolled in two Physically Active Living Skills classes - an exergaming course ($n = 6$) and a traditional personal fitness course ($n = 6$). Repeated measures ANOVA indicated that there were significant time by group interactions for the Stroop Interference Score, the PASAT, frequency of exercise, amount of PA, and perceived health. The traditional PA group experienced more cognitive gains, higher perceived health, more physical activity participation, and exercised on more days of the week than the exergaming group. However, fitness was maintained equally in both groups. The results showed that benefits from traditional PA were greater than those obtained during an exergaming program and do not support this form of exergaming as a means by which to increase PA, fitness, or cognitive performance. Future research should investigate how traditional PA is different from exergaming, and which factors (psychological, physiological, and behavioral) could be influencing the differences that were found.

A university dimension of wellness class impact on behavioral regulation in exercise: A pilot study

Barton-Weston, Heather; Henrich, Timothy W.; Soukup, Gregory J.; Carleton, Bill; University of the Incarnate Word

The CDC and ACSM have reported 30 min of daily moderate intensity physical activity can significantly improve health. Racette, Deusinger, Strube, Highstein, and Deusinger (2005) found 7% of incoming university freshman discontinue regular physical activity between freshman and sophomore years. The University of the Incarnate Word requires students complete a Dimensions of Wellness course to graduate. Twice a week students attend class and participate in 30-minute structured aerobic exercise activities. They also must exercise 30 min per week outside of class. The CDC states there are physiological, behavioral and psychological determinants to physical activity participation. The Behavioral Regulation in Exercise Questionnaire (BREQ-2) measures five different behavioral variables. This study measured the impact the UIW wellness class had on BREQ-2 scores. Data were collected from university wellness students at the beginning (PRE) and end of the class (POST). There were 63 participants (45 females/18 males) with a mean age of 19.5 years. Ethnic composition was 35 Hispanics, 21 Caucasians, and 7 African-Americans. Significant PRE/POST differences in identified regulation ($p < .017$), internal regulation ($p < .008$) and external regulation ($p < .041$) were found among students. Age was correlated post-test with both amotivation ($r = .321$: $p < .011$) and introjected regulation ($r = -.285$: $p < .024$). There were no significant differences determined between genders and races. Identified regulation was predicted (POST) by age ($F = 2.8$, $SE = .219$, $R^2 = .162$, $p < .008$) and classification ($F = 2.8$, $SE = .043$, $R^2 = .162$, $p < .025$). Students obtained higher scores in identified, internal, and external regulation of exercise following the wellness class. Age and class rank were related with interjected and amotivation regulation of exercise. Maturity factors of age and classification were important factors in predicting identified regulation. This study suggests significant increases in student internal and identification regulation could be attributed to wellness class participation

Transformational teaching and adolescent physical activity behavior: Multilevel and mediational effects

Beauchamp, Mark R.; Liu, Yan; University of British Columbia; Morton, Katie L.; University of Cambridge; Martin, Luc J.; Wilson, Alexandra H.; Wilson, A. Justine; Sylvester, Benjamin D.; Kermer, Lindsey E.; Perlmutter, Lisa S., University of British Columbia

Recent research has extended the tenets of transformational leadership theory (Bass & Riggio, 2006) to understand the effects of teacher behaviors in relation to a range of adolescent health outcomes (Beauchamp et al., 2010; 2011). The overall purpose of this study was to examine the prospective relationships between adolescents' perceptions of "transformational teaching" (cf. Beauchamp & Morton, 2011) within the contexts of school-based physical education, and adolescents' subsequent affective attitudes (i.e., enjoyment) towards physical education and within-class physical activity (WCPA) and leisure time physical activity (LTPA) behaviors. Two thousand nine hundred and seventy seven adolescents (M_{age} = 14.33, SD = 1.00) from 133 Grade 8-10 classes provided ratings of their physical education teachers' behaviors mid-way through the school year, and two months later were invited to complete measures of class enjoyment, WCPA, and LTPA. Using multilevel structural equation modeling, the results provided evidence of good model-data fit with regard to the a priori multilevel model (chi square (22) = 113.78, $p < .001$, CFI = .99, TLI = .98, RMSEA = .04, $SRMR_{within}$ = .02, $SRMR_{between}$ = .04). At the individual level, adolescents' perceptions of transformational teaching were able to explain significant variance in both WCPA and LTPA and both of these relationships were mediated by adolescent enjoyment of physical education. At the group-level, class enjoyment was both predictive of class LTPA and was also predicted by class perceptions of transformational teaching. Consistent with theorizing by Beauchamp and Morton (2011), the results of this study provide evidence in support of the hypothesis that transformational leadership, as displayed by school physical education teachers, is related to improved physical activity behaviors among adolescents.

Exploring the transferability of life skills from sport to general life contexts

Beesley, Theresa; Fraser-Thomas, Jessica L.; York University

It is commonly assumed that transferability of life skills from sport to general life contexts occurs automatically. Despite current literature suggesting youth have the potential to apply life skills learned in sport to other contexts, little research has explored what skills are being transferred and how this transferability may be occurring (Gould & Carson, 2008; Slutzky & Simpkins, 2009). Further, previous research has focused primarily on elite competitive athletes, with little exploration of transferability among youth in other sport contexts (Fraser-Thomas et al., 2005). The objectives of this study were (a) to identify the life skills youth transfer from their school sport contexts into their daily lives, and (b) to explore factors influencing the transfer of life skills developed in the school sport contexts to other life contexts. Using a case study design, focus group interviews were conducted with 26 grade 7 and 8 students (ages 11-13) attending a private school in a large Canadian city. Focus group interviews were conducted at two time points (i.e., at the beginning and end of the physical education (PE) term or school sport season), and comprised of 2-5 students, following a semi-structured interview guide. Results revealed girls on competitive school teams reported transferring life skills from sport contexts to general life most often, in the form of self-confidence and communication skills. Girls involved only in PE reported minimal transferability of life skills, despite a strong understanding the value of learning life skills and utilizing them in other contexts. Conversely, boys on competitive school teams reported no transfer of life skills from sport to general life. Additionally, findings suggested that transfer occurred most often when promoted and facilitated by coaches and teachers. Findings will be discussed further within context of previous research suggesting transfer is not automatic, but increases when the value of life skills development is emphasized in the sport setting (Danish, et al., 1993).

Evaluating the take-the-first heuristic in assessing situations and decision making using an option generation paradigm in soccer

Belling, Patrick; Ward, Paul; Michigan Technological University

The take-the-first (TTF) heuristic suggests that when good decision makers generate future courses of action (i.e., intervention-based options), they generate the best, or a workable (i.e., task-relevant), option as their first. As more options are generated the likelihood of choosing the best decreases (Johnson & Raab, 2003). Similar claims have been made when assessing and predicting opponents' next moves (Klein & Peio, 1989). The current research examined both types of decisions (i.e., interventions and assessments) using an option-generation paradigm in soccer. High-skilled and less-skilled soccer players viewed dynamic sequences of soccer play and generated intervention- and assessment-based options separately. In agreement with TTF, during intervention, high-skilled players generated the best ($d = .40$, $p < .05$) or a task-relevant ($d = .56$, $p < .01$) option more frequently than less-skilled players. Both groups generated a higher frequency of best ($p < .01$) or task-relevant ($p < .01$) options as their first option, compared to options generated second and third. The effects were identical when making assessments—high-skilled players generated more threatening options more often than less-skilled players ($d = .44$-$.68$, $p < .01$-$.05$), and both groups more frequently generated more threatening options first ($p < .01$). Counter to TTF, the number of options generated and decision quality were not correlated. Only the number of poor (i.e., task-irrelevant) options generated ($p < .05$) was negatively correlated with, and the ability to prioritize generated options ($p < .01$) was positively related to, decision quality. During assessment, the number of total, task-relevant, and task-irrelevant options were not correlated with anticipation accuracy. However, contrary to TTF, the number of task-relevant and -irrelevant options generated were positively and negatively correlated, respectively, with the ability to recognize the most threatening option ($p < .05$). Moreover, the ability to prioritize threatening options was significantly correlated with anticipation accuracy ($p < .05$).

Exploring breast cancer survivors' experiences of the Curves for Women physical activity program

Bessette, Natalia; Dhindsa, Amy; O'Loughlin, Erin; Sabiston, Catherine; McGill University

Physical activity provides physical, psychological, and social health and well-being benefits to women who have been diagnosed and treated for breast cancer. Recently, the American Council on Sports Medicine (ACSM) convened an expert panel and developed physical activity guidelines for cancer survivors. During this process, the need to assess the efficacy and safety of alternate types of physical activity was highlighted. The Curves for Women circuit training program was mentioned as a viable yet understudied physical activity opportunity for survivors. Based on these recommendations, this descriptive qualitative study explored breast cancer survivors' perceptions and experiences of the Curves for Women program. A purposeful sample of seven women ($M_{age} = 56$ years) who were given memberships for a one-year period were interviewed to better understand the benefits and barriers associated with the Curves program. The data was organized, stored, and coded using Nvivo 8*. The women discussed the trainers' knowledge of exercise as a motivator for women who were less physically active, but an inhibitor for women who were more physically active and who expressed a desire for different types of information. Additionally the pace of the circuit training yielded varying opinions. A few women found the pace too challenging and one

found it not challenging enough, and this circuit characteristic inhibited attendance and enjoyment of Curves. However, for four women it was sufficiently challenging and this motivated attendance. In spite of the number of Curves locations locally, the distance to the Curves center seemed to act as a barrier to attendance. Additionally given the group nature of Curves, a lack of personalized physical activity program negatively impacted attendance for some women. However, for three women, the community feeling of Curves enhanced their experience. The results of this content analysis serve as a first step to exploring ecologically valid physical activity opportunities for breast cancer survivors.

Coach perspectives on their role as support providers in recovery from sport injury

Bianco, Theresa, Concordia University

Several studies (e.g., Bianco, 2001; Johnston & Carroll, 1998; Shelley, 1999) have reported that injured athletes have a need for coach support and that the support received can have a positive impact on how they cope with injury. Little is known, however, about how coaches view their role as support providers in recovery from sport injury. To shed light on the issue, 10 high performance coaches were interviewed individually while 6 others participated in a focus group interview. Results showed that coaches perceived their role as falling into six major categories: ensuring injured athletes received adequate support from others, keeping injured athletes involved in sport, monitoring injured athletes' rehabilitation and recovery, and providing injured athletes with emotional, informational and tangible support. The coaches also recognized that the support they provided could have both short and long-term benefits for themselves and their athletes. These results are promising because they align well with what injured athletes have identified as coach support needs (e.g., Bianco, 2001; Ford, 1999). Further research is needed to examine the actual provision of coach support with a view to identifying factors that may facilitate or hinder the support process.

The time course of change in older adults' cognitive processing speed during an 11-week exercise intervention

Biggan, John; Taylor, Wyn; University of Texas at Arlington; Shannon, Vale; Tarleton State University; Ray, Christopher T.; University of Texas at Arlington

In a general sense, research suggests that cognitive speed declines with increasing age. However, it is also known that active individuals show less of a decline with age than their less active counterparts. Yet, the mechanisms and the time-course of the direct effect of an exercise intervention on cognitive speed in an older population are poorly understood. The purpose of this study was to address this effect by examining change in cognitive speed over the course of an 11-week exercise intervention. Twenty-eight older adults (17 females, 11 males), age 55 to 92 (M = 75.54, SD = 7.87) were recruited from a cohort of older individuals taking part in one of two exercise interventions (Pilates or fitness training using the Nintendo Wii) through the Center for Healthy Living & Longevity at the University of Texas at Arlington. Three measures of mental processing speed (reaction time, letter comparison, and picture comparison) were collected at 4-week intervals (pre, 4 weeks, 8 weeks, and 12 weeks) to provide processing speed scores for the participants. No significant differences were found for the type of exercise intervention (Pilates of Nintendo Wii). Also, the reaction time (RT) and picture comparison (PC) tasks did not change significantly over the time-course of the intervention. However, the speed of response of the letter comparison (LC) task was significantly affected by the intervention such that speed increased linearly (Pre-4 weeks 10.76%; 4-8 weeks 8.97%) during the first three time points and did not change

significantly between the third and fourth time point (-5.72%). Therefore, older individuals taking part in an 11-week exercise intervention showed steady increases in cognitive speed during the first 8 weeks of the intervention. In addition to gaining information about the neuro-cognitive processes related to aging, these findings may have practical implications for rehabilitation with older persons.

Living with osteoporosis/osteopenia and well-being: Implications for meeting physical activity guidelines

Blais, Louise; Mack, Diane E.; Wilson, Philip M.; Olson, Megan M.; Brock University

Establishing the magnitude of the relationship between participation in regular physical activity and well-being in individuals living with osteopenia/osteoporosis has been identified as an important research priority (Li et al., 2009). However, the mode of physical activity assessment may differentially influence the physical activity/well-being relationship in older adults (Parker et al., 2008). The purpose of this study was to examine whether differences in well-being were reported for individuals who met public health guidelines for moderate and vigorous physical activity (MVPA) and pedometer-determined walking behavior (PDPA) and those who did not in a sample of women with osteopenia/osteoporosis. Participants (N = 84; M_{age} = 68.02 years) were individuals living with osteoporosis who completed a self-report survey that included a modified Godin Leisure-Time Exercise Questionnaire (LTEQ; Godin et al., 1985), the Satisfaction with Life Scale (SWL; Diener et al., 1989) and Flourishing Scale (FL; Diener et al., 2009) on a single occasion. PDPA was determined across a consecutive 7-day monitoring period (Yamax Digiwalker; CW-701; Yamax, Tokyo, Japan). Women achieving public health PA guidelines reported greater well-being regardless of mode of assessment, with greater differences noted when FL served as the measure of well-being (Cohen's $d > .37$) than SWL (Cohen's $d > .14$). Collectively, results offer support for achieving public health physical activity guidelines on well-being in individuals living with compromised bone health. Implementing strategically designed physical activity behavior change programs in this cohort represents an important public health priority.

Physical activity in adolescents: The role of the built environment from a GPS perspective

Blanchard, Chris M, Dalhousie University; Shearer, Cindy, Atlantic Health Promotion Research Center; Rainham, Daniel, Dalhousie University; Kirk, Sara, Dalhousie University; Shields, Chris, Acadia University; Pitter, Robert, Acadia University; Dummer, Trevor, IWK Health Centre; Lyons, Renee, Bridgepoint Health

Background: Statistics suggest that 7% of youth and adolescents in Canada are meeting the current moderate to vigorous physical activity (MVPA) guidelines. One area of research that is receiving significant attention is the association between the built environment and MVPA. Although preliminary research is showing a significant association, few studies in adolescents have examined multiple components of the built environment simultaneously using objective measures generated from GPS-related geographic boundaries. The purpose of the current study was to examine the association between built environment characteristics (e.g., walkability, access to MVPA opportunities, fast food restaurants, etc.) and MVPA in adolescents. Methods: 314 adolescents (12 to 16 years of age) wore an accelerometer and GPS data logger for up to 7 days. Total MVPA minutes per day accumulated within bouts of MVPA (i.e., at least 10 min) were generated from the accelerometers. GPS data was used to create geographic boundaries based on student behavior, after which, 9 different

objective built environment variables were generated within ArcGIS. Results: Using a Bonferroni correction of $p = .01$, partial correlations controlling for school SES, whether the school was urban/suburban vs. rural, sex, and grade showed that MVPA minutes per day was significantly correlated with increased walkability ($r = .23$, $p = .00$), increased access to walking paths, parks, etc. ($r = .15$, $p = .01$), and increased access to trails ($r = .19$, $p = .00$). A follow-up multiple regression analysis competing these variables showed that MVPA minutes per day were significantly predicted by walkability ($\beta = .23$, $p = .04$), but not access to walking paths, parks, etc. ($\beta = .01$, $p = .87$) or trails ($\beta = .09$, $p = .25$). Conclusion: Various built environment characteristics appear to be associated with MVPA minutes per day in adolescents; however, the key characteristic appears to be walkability when using objectively measured location and activity data.

Distinct trajectories of light and moderate to vigorous physical activity in heart disease patients who do not attend cardiac rehabilitation

Blanchard, Chris M.; McSweeney, Jill; Giacomantonio, Nicholas; Dalhousie University; Reid, Robert, Ottawa Heart Institute; Rhodes, Ryan, University of Victoria; Spence, John, University of Alberta; Murnaghan, Donna, University of Prince Edward Island; McGannon, Kerry, Laurentian University; Balish, Shea, Dalhousie University

Objective: Research suggests that light and moderate to vigorous physical activity (MVPA) has beneficial effects concerning longevity in heart disease patients. Yet, very little is known about the physical activity trajectories of patients who do not attend cardiac rehabilitation programs and whether the demographic / clinical predictors of these trajectories are similar for light and MVPA. Methods: Patients ($N = 223$) completed a questionnaire assessing demographic, clinical, and physical activity variables at baseline, three, six, nine, and 12 months after hospitalization for heart disease. Charts were reviewed for height, weight and clinical diagnosis. Results: Latent class growth analyses showed two classes of patients emerged for light physical activity (i.e., patients who remained inactive and patients whose physical activity levels significantly declined) and MVPA (i.e., patients whose physical activity significantly increased and patients whose activity levels significantly decreased). Light intensity class membership was predicted by education (OR = 2.74) and diagnosis (OR = .43), whereas MVPA class membership was predicted by age (OR = .95) and gender (OR = 4.69). Finally, dual trajectory analyses showed that patients whose activity levels declined for one intensity had a high probability of transitioning into the declining group for the other intensity. Conclusions: Physical activity trajectories for heart disease patients vary as a function of intensity as do the demographic / clinical predictors of these trajectories.

Study of experiential perception of *heung* in Korean dance

Bong-Hee, Shin; Ji-Hye, Chung, Sookmyung Women's University; Duk-Sun, Chung, Korea National Sport University; Jung-Hoon, Huh, Chung-Ang University

This study aims to explore the intrinsic factors of *heung* (a feeling of lively animation or enthusiasm), which Korean dance gives based on the opinion of the Korean dance experts. A survey on the experience and factors of *heung* was conducted on the seven Korean dance experts (three males and four females) with more than 25 years of career, using an open-ended questionnaire. From the analysis on the collected raw data, it was found that *heung* consists of 10 areas as follows: naturalness, assimilation, inspiration, delight, comfort, sense of accomplishment, consentience with audience, consentience with musical performance, impromptu amusement, transcendency, and sublimation. The general area was classified

into four sub-areas such as fortuity, genuineness, integrity, uniqueness and, in structural meaning, classified into three factors such as internal factor, external factor and behavioral factor. The results of this study on *heung* will provide helpful information for dancers to extensively understand the concept of *heung*, which is an essence of Korean dance associated with Korean psychological characters.

Ethical decision-making training as a chance for doping prevention?

Brand, Ralf, University Potsdam; Elbe, Anne M., University Copenhagen

Doping is becoming an increasing problem in elite sports, leading to more interest in anti-doping and prevention programs especially in youth sport. However, current doping prevention programs that primarily involve knowledge enhancing educational strategies have not shown to be very effective. This presentation focuses on a new sport psychological approach to doping prevention by targeting the individual's decision-making process. Our project aimed to analyze if a newly developed ethical decision-making training can influence young athletes' doping attitudes. Using an interactive online training approach, athletes were confronted with sport related dilemma situations in which they needed to create, evaluate and rank arguments for and against the decision to dope. Through this reflective process the athletes were supposed to learn how to cognitively resolve the doping situation, enabling them to make reflected decisions. A RCT was conducted with 30 young athletes in the ethical decision-making group (EG), 22 in a standard knowledge-enhancing intervention group (KG), and 17 in a no-treatment control group (CG). A short version of the Performance Enhancement Attitude Scale (PEAS; Petroczi & Aidman,2009) was used as the dependent variable. Additionally, qualitative data was collected from the participants. The repeated measures ANOVA interaction term signals a significant increase of the PEAS-score indicating a more "positive" attitude towards doping in the EG. The scale value, however, is still to be categorized as "staying away from doping." No changes occurred in the other two groups. The results can be interpreted in the way that the ethical training was successful in breaking up the participants' former stereotype thinking and answering schemes on doping behavior. We conclude that a most desirable effect was achieved with this newly designed intervention tool.

Relationships between parents' perceptions and preschooler physical activity: An application of the theory of planned behavior

Bray, Steven R.; Saville, Paul D.; Proudfoot, Nicole A.; Timmons, Brian W.; McMaster Univ.

Until recently, the only physical activity guidelines available for young children (< 5 years) recommended preschoolers accumulate at least 60 min of structured and 60 min of unstructured activity per day. Young children lack autonomous control over their activity levels, yet parents face challenges to provide active opportunities for their children. The purpose of this study was to investigate relationships between parents' perceptions about their preschoolers' physical activity and children's activity levels. Using the theory of planned behavior (TPB), we assessed parents' attitudes, subjective norms, perceived control, self-efficacy, and intentions regarding their preschooler's physical activity for the upcoming week. Primary caregiver parents ($N = 84$) completed measures at an initial testing session and their child (mean age = 4.5 years) wore an accelerometer during the following 7-day period. Parents' attitudes, subjective norms, intentions, and self-efficacy were generally high, while perceived control was moderate. Children's total activity levels were above recommended levels ($M = 256.07$ months 37.25 min/day), while moderate- vigorous activity

(MVPA) averaged 92.34 (*SD* = 21.14) min/day. Consistent with the predictions of the TPB, attitudes, subjective norms and self-efficacy predicted intentions (adj. $R^2 = .53$, $p < .001$). However, there was no association between intention, perceived control, and self-efficacy and either total activity (adj. $R^2 = .02$) or MVPA (adj. $R^2 = .00$). Findings are reflective of other research supporting the TPB in the prediction of behavioral intentions. Although the sample was very active, the intention-behavior disconnect raises issues regarding the importance of parents' beliefs for young children's activity involvement and physical activity promotion efforts for preschoolers.

"They believe I can do it . . . , and this is how I know!": Youth sport participants' perceptions of verbal and non-verbal feedback on relation-inferred self-efficacy

Bray, Steven R.; Martin Ginis, Kathleen A.; Cairney, John; Marinoff-Shupe, Debbie; Pettit, Andrew; Saville, Paul D.; Graham, Jeffrey D.; Tran, Alex; McMaster University

Sport participation among children is dwindling compared to previous decades. Research shows that children who come to doubt their abilities lose their motivation to participate in sport. These beliefs arise, in part, through feedback and perceptions about what others perceive about one's own abilities (relation-inferred self-efficacy [RISE]). RISE is theorized to play a role in the development of self-efficacy and intrinsic motivation. The purpose of this study was to identify sources of RISE among youth sport participants. Instructional sport camp participants ($N = 61$, ages 7-12) took part in semi-structured interviews exploring their experiences and perceptions of their instructors' behaviors. Specific questions relating to RISE prompted participants to provide examples of verbal and non-verbal behaviors used to convey RISE (e.g., what did they do? what did they say? how did they say it?). Data were transcribed and content analyzed. Participants described sources of RISE in terms of verbal ($n = 489$) and non-verbal behaviors ($n = 351$). Categories of verbal and non-verbal behaviors were formed through deductive triangulation. Verbal behaviors included General Encouragement (e.g., "you did very well") and Efficacy-building Statements (e.g., "I believe you can do this"). Non-verbal behaviors included Expressiveness (e.g., giving a high 5), Instructional Endorsement (e.g., picks me to show other kids how to do it), and Participation Opportunities (e.g., puts me in to guard the best player). Findings are consistent with theorizing (Lent & Lopez, 2002) regarding RISE as an intermediary perception following interpersonal interactions and as a source of self-efficacy.

A non-linear method for assessing factors contributing to decision making expertise

Bruce, Lyndell; Farrow, Damian, Victoria University; Raynor, Annette, Edith Cowan University

Sport expertise researchers investigating the training history profiles and/or performance milestone data of athletes often collect very large amounts of data. In most cases, this data needs to be analyzed separately or through the use of discriminate or regression analysis, which, with a large number of predictor variables can mis-specify data (Piper, Loh, Smith, Japuntich, & Baker, 2011). In addition, regression methods are compromised if there are too many predictor variables as you cannot explore all the main effects and interactions as the sample size is exceeded and a large number of predictor variables can make interpretation difficult, especially if there are a number of interactions in play (Piper, et al., 2011). An alternative analysis method is non-linear decision tree analysis, whereby the dependent variable is assessed to observe which of the predictor variables are most influential in

group classification (Han & Kamber, 2006). Forty-four expert, developmental and recreational netballers were classified according to on-court decision-making performance. Using a variety of performance milestones, training history profile data, and familial information, decision tree analysis was performed to identify the factors that were most predictive of achieving expert decision-making performance, irrespective of skill level. It was observed that the best decision makers were characterized by having greater than 13 years of experience in their chosen sport (netball) and investing a greater number of hours in sports excluding netball during the specializing years (13-15 years). The poorest decision makers were characterized by less than 13 years of netball experience, beginning netball at age nine or older and having less than two siblings. Han, J., & Kamber, M. (2006). Data mining: Concepts and techniques. San Francisco, USA: Morgan Kaufmann Piper, M. E., Loh, W.-Y., Smith, S. S., Japuntich, S. J., & Baker, T. B. (2011). Using decision tree analysis to identify risk factors for relapse to smoking. Substance Use & Misuse, 46(4), 492-510.

An investigation into the influence of family background on expert performance

Bruce, Lyndell; Farrow, Damian, Victoria University; Raynor, Annette, Edith Cowan University

Whilst there is a body of evidence investigating the influence of family on sport participation and performance, this has been constrained to the support mechanisms provided by the family including direct parental influence, relationships with siblings, monetary support, emotional support and time allowance (including transportation to and from practice and competitions) (Côté, 1999; Stevenson, 1990). Little research has been dedicated to the effect parent's and sibling's individual sports participation can have on their child/sibling and whether this differs across various levels of sport expertise. The current study recruited fifty-nine female netballers of three skill levels (expert, developmental and recreational) and examined the influence of parent's and sibling's highest level of sporting achievement and number of sports played relative to the participant's current level of sporting accomplishment. Further analyses considered the number of siblings (male and female), birth order effects, and the age of siblings relative to the participant's level of expertise. Results revealed that the parents of the expert and developmental athletes had achieved a significantly higher level of representation in sport than the parents of the recreational participants ($p <= .05$). In addition, the oldest sibling of the expert athletes had played sport at a significantly higher level than the oldest sibling of the recreational participants ($p <= .05$). The expert and developmental athletes were typically not the oldest sibling in their family, in contrast to the novices who were more likely to be the oldest child ($p = .06$). The current evidence highlights significant familial influences in the development of sport expertise. Côté, J. (1999). The influence of the family in the development of talent in sport. The Sport Psychologist, 13, 395-417. Stevenson, C. L. (1990). The early careers of international athletes. Sociology of Sport Journal, 7(3), 238-253.

Youth encouraging youth to be active: The role of peer ambassadors in promoting the community physical activity pass

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Over 90% of Canadian children and youth are not meeting national guidelines for physical activity (PA; Colley, 2011). Common barriers to PA highlighted by adolescents include

cost and distance to recreational facilities (Humbert et al., 2007). A Community PA Pass, giving free access to all local pools ($n = 4$), ice skating rinks ($n = 7$), and the local YMCA ($n = 1$) from November 2009 to August 2010 was distributed to all grade 9 students (n = ~2500) in a mid-size Canadian city. Building upon findings from previous Community PA Pass evaluations, the purpose of this study was to determine the effectiveness of a peer-led promotional campaign to enhance youth uptake of the PA Pass. Six schools participating in the Community PA Pass were enrolled in the study. Participating schools were matched based on size, location and socioeconomic status, then randomized to either the intervention ($n = 3$; enhanced promotion of PA Pass via peer ambassadors) or comparison group ($n = 3$; Standard promotion of PA Pass). Prior to and 7 months after receiving the PA Pass, Grade 9 students ($N = 219$) self-reported recreational facility use and completed the Physical Activity Questionnaire-Adolescents (Kowalski et al., 1997). Pass use and peer ambassador effectiveness was assessed at 7 months. A 2×2 mixed ANOVA was used to compare change in PA over time between groups. Overall, 31% of the sample reported using the PA Pass (28% in the comparison group; 38% in the intervention group); however, the difference in Pass use between groups was not significant. One-third of participants in the intervention group reported awareness of peer ambassadors in their school to promote the PA Pass; however, only 10% of the respondents reported awareness of promotional activities for the Pass in the school. The results of this pilot study can be used to guide program decisions and refine community-wide strategies to enhance PA among our youth. Future research will explore the strengths and limitations of using same-age peer leaders to promote PA.

The impact of a group-based lifestyle intervention on obese children's self-efficacy for physical activity

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The Children's Health and Activity Modification Program (C.H.A.M.P.) is a 4-week community-based lifestyle intervention for obese children and their families. The program, delivered during August 2008 and 2009, consisted of several components: (1) daily group-based physical activity (PA); (2) behavior modification counseling; (3) dietary counseling; (4) weekly educational sessions for families; and (5) post-program support. Objectives were to improve PA levels, dietary behaviors, and a number of physiological and psychological outcomes. The purpose of the present study was to examine the impact of C.H.A.M.P. on children's task and barrier self-efficacy for PA. Children (53% female; mean age = 10.5; BMI > 95th percentile for age and sex) completed an adapted version of the Self-Efficacy Scale (McAuley & Mihalko, 1998) at 4 time points (i.e., baseline, one week post-intervention, 3- and 6-months post-intervention). For task efficacy, participants rated their confidence to complete PA for increasing time periods at various intensities. Barrier efficacy was assessed using six barriers that prevent children from participating in PA. Both were rated on a scale ranging from 0% (no confidence at all) to 100% (completely confident). A repeated-measures ANOVA revealed that overall, task efficacy scores differed significantly between time points, $F(2.42, 79.95) = 16.41$, $p < .001$; partial $\eta^2 = .33$). Post hoc tests revealed significant increases in task efficacy between baseline and post-intervention ($p = .001$); baseline and 3 months post-intervention ($p < .001$); and baseline and 6 months post-intervention ($p = .002$). Similarly, with regard to barrier efficacy, a repeated measures ANOVA revealed a significant difference between time points, $F(3, 99) = 5.52$, $p = .002$; partial $\eta^2 = .14$). Post hoc results revealed significant increases in barrier efficacy from baseline to 3 months

post-intervention (p = .022) and baseline to 6 months post-intervention (p = .031). Results are discussed in relation to self-efficacy theory and the promotion of PA for overweight and obese children.

Physical activity among Latino children: A qualitative examination of barriers and facilitators

Burke, Shauna M.; Mandich, Gillian E.; University of Western Ontario

Latino children are disproportionately affected by overweight and obesity; up to 27% of Latino children in the United States have body mass indices (BMIs) = 95th percentile for their age and sex (Ogden, Yanovski, Carroll, & Flegal, 2007). Most interventions aimed at promoting PA among Latino children have failed to address the PA-related barriers and facilitators that may be unique to this population. The present study was conducted as part of a larger study designed to assess the PA levels and SB of Latino children. The purpose of the current study was to gather qualitative data to gain a preliminary understanding of the PA-related barriers and facilitators that are relevant to Latino children (ages 10 to 14) in London, Ontario, Canada. Children were recruited at community events, through flyers placed at local Latino establishments, and via word of mouth. Forty boys and 34 girls (mean age = 11.4 years, SD = 1.3) completed a series of questionnaires which included open-ended questions pertaining to PA-related barriers and facilitators. Participants identified a number of barriers to PA, including: a lack of resources (equipment, finances, transportation); environmental factors (safety concerns, health concerns, distance from PA centers); lack of opportunities for PA (outdoor play, organized activities); lack of motivation (too tired, lack of encouragement to engage in PA); lack of time (scheduling); and screen time (time spent watching TV, on the computer, or playing video games). In terms of PA-related facilitators, Latino children identified the need for additional motivation (encouragement to engage in PA); opportunities for skill development; social support from friends and family; physical fitness or weight loss outcomes; opportunities to participate in organized PA (outdoor play, sports); and information about PA opportunities in the community. Results will be discussed: (a) within the context of the larger study; and (b) in terms of their potential to inform future PA interventions for Latino children.

Climbing towards recovery: Investigating physically injured combat veterans' psychosocial response to scaling Mt. Kilimanjaro

Burke, Shaunna; Utley, Andrea; University of Leeds

Purpose: To explore physically injured combat veterans' psychosocial response to scaling Mt. Kilimanjaro. Method: Participants (n = 4) were male and ranged in age from 22 to 44 years. They had all been physically injured as a result of active duty in Afghanistan between 15 and 42 months before the study. Data were collected throughout the 11-day climb on Mt. Kilimanjaro using multiple sources of ethnographic data collection techniques including semi-structured interviews and detailed observations. Data were analyzed using cross case and within case analysis. Results: The findings are divided into themes that were drawn out of the data to illustrate the participants' psychosocial response to their experience climbing on Mt. Kilimanjaro. The key themes of resilience, optimism, active coping, and social support were identified from the data. Discussion: Future research should explore the role of challenging and meaningful activities as a way of improving the process of recovery and adjustment following serious injury.

The cognitive representation of directions in auditory space: The influence of sight condition and skill level in orientation

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The improved development of auditory perception and processing in the blind is linked to the enhanced demand of orientation without visual information. We investigated mental representation structures of auditory space (AS) in participants with different sight conditions and skill level in orientation, in order to find out whether the different conditions would result in different representation of AS. We applied a hierarchical sorting paradigm (Structure Dimensional Analysis) to examine the mental representation of AS of three groups: 1) 9 professional blind soccer players (BS); 2) 9 blind non-athletes (BN), and 3) 9 sighted control subjects (C). BN and C were not participating in any sports activity, and all participants were blindfolded. While standing in the middle of a circle with 16 sound sources (SS), participants were presented pairs of identical acoustic stimuli coming from two of the SS, and asked to judge if the directions of these SS were similar or not. All possible combinations of SS were applied once. The hierarchical cluster analysis revealed different results for the three groups, corresponding to different mental representations of AS. For the BS, five clusters were formed, each including two neighboring SS. The BN cluster solution consisted of only two clusters comprising two SS each. The C group included all SS, except the absolute back, in four clusters. Our results indicate that the representation of egocentric auditory space is influenced by the sight condition and, in blind people, by the skill level in orientation. We conclude that sighted people conceive egocentric space mainly on the basis of visual information, thus the spatial resolution for AS, especially of the sides, is poor. Blind people, in contrast, use primarily auditory information to conceive space, which is reflected by a higher spatial resolution and a more distinctive representation structure. Furthermore, the cognitive structure of AS representation seems to be linked to the level of orientation skills, which are enhanced by training in professional blind soccer experts.

Effects of soccer ball "heading" intensity on memory, reaction time, and impulse control

Capiola, August; Raudenbush, Bryan; Dennis, David, Wheeling Jesuit University

Past research is contradictory concerning the detrimental effects of soccer ball "heading" on memory, and lacking in the areas of reaction time and impulse control. The present study examined the effects of heading intensity on these neuro-cognitive variables. Men and women soccer teams completed the Impact Neuro-cognitive Assessment protocol before and after their competition seasons. Groups were formed for data analysis based on average heading intensity during competition, and the data were analyzed using a Multivariate Analysis of Variance (MANOVA) on measures of verbal memory, visual memory, motor speed, reaction time and impulse control. A significant MANOVA result was found, $F = 327.47$, $p < .001$. Athletes engaging in high-intensity heading had decreased verbal memory and increased reaction time scores pre- to post-season, indicating a detrimental effect of high-intensity heading. Pre- to post-season impulse control scores decreased in athletes engaging in low-intensity heading, but were unchanged in athletes engaging in high-intensity heading, suggesting additional attentional workload was required of those athletes to complete the neuro-cognitive assessment. Significant correlations were noted among the neuro-cognitive assessment measures and variables such as heading frequency, post-heading dizziness, and concussion history. Thus, significant detrimental effects on

memory, reaction time, and impulse control are associated with high-intensity soccer ball heading. These data indicate the need for education and intervention related to safer heading techniques in the sport.

Examining perceived strength of barriers to physical activity across three adult age cohorts using an ecological framework

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Identifying barriers to physical activity (PA) using a social-ecological framework is a valuable approach because multiple levels of influence including personal barriers and surrounding environmental constraints are considered (Sallis et al., 2006). This study used a social-ecological framework to examine adults' perceived barriers to PA in intrapersonal, interpersonal and physical environment categories (Giles-Corti & Donovan, 2002), as a function of age group (45-54; 55-64; 65-74 years) and PA status (active, less active). 116 Canadian adults (69 f, 47 m) completed a survey assessing PA (Godin & Shephard, 1985) and the extent to which various barrier items (e.g., Booth et al., 2002; Humpel et al., 2002) were limiting. A MANOVA revealed a main effect of PA, $F(3,56) = 11.2$, $p < .001$, where less physically active adults more strongly reported barriers than active adults in intrapersonal, $p < .001$, interpersonal, $p < .001$, and physical environment categories, $p = .03$; other main effects and interactions were non-significant. Exploratory factor analyses identified sub-factors within each ecological category. For each of 16 emergent sub-factors, age by PA group ANOVAs were conducted for barrier strength ratings. Less active adults reported stronger barriers related to "self-efficacy & motivation," "attitude toward PA," "spouse," "family members," "neighborhood characteristics," and "opportunities near home," all ps $< .02$. 65-74 year-olds reported stronger barriers related to "co-workers" than 55-64 year-olds, and 45-54 year-olds reported a greater influence of barriers related to "opportunities near work" than 65-74 year-olds, both ps $< .04$. Discussion addresses how differences in barrier strength across and within ecological categories appear to depend most often on PA status than age group or interactions between PA and age. Finally, we align current findings with relevant behavioral, social support, and work-place strategies to remediate PA deficiencies. This research is partly funded by a Strategic Initiative Grant from Social Sciences & Humanities Research Council of Canada.

Staying active when arthritis symptoms are severe: Self-regulatory efficacy predicts physical activity during arthritis flares

Cary, Miranda A.; Sessford, James D.; Gyurcsik, Nancy C.; Brawley, Lawrence R.; Spink, Kevin S.; University of Saskatchewan

People with arthritis often report factors of pain intensity and other arthritis-related barriers (e.g., swollen joints, tiredness) as interfering with their moderate to vigorous physical activity (MVPA), an advocated self-management behavior. These factors are typically assumed to predict MVPA. Self-regulatory efficacy beliefs (SRE) may also predict MVPA, particularly when people's arthritis symptoms are exacerbated (i.e., flare). The purpose of our prospective study was to examine whether SRE to overcome arthritis barriers (SRE-AB) and schedule/plan MVPA (SRE-S/P) were significant predictors of MVPA, after controlling for pain intensity and arthritis barriers (i.e., frequency and extent of limitation). We examined 56 adults ($M_{age} = 49.41 \pm 11.56$ years) in an arthritis flare over a two-week study period. At time 1, participants completed online measures of overall arthritis pain, frequency and limitation of arthritis barriers, SRE-AB, and SRE-S/P. Two weeks later, a measure of

MVPA was obtained. A hierarchical multiple regression predicting MVPA was conducted in which the covariates of pain and arthritis barriers (frequency and limitation) were entered in Step 1, followed by SRE-AB and SRE-S/P in Step 2. The model was significant, $F(5, 50) = 3.41$, $p < .01$, R^2 adj. = .18. SRE-AB and SRE-S/P contributed significant variance to the prediction of subsequent MVPA (R^2 change = .15, $p < .01$), after controlling for the covariates. SRE-S/P was the strongest predictor (β stand. = .37, $p < .05$). Surprisingly, the covariates of pain and other arthritis barriers were not significant predictors despite their frequent reporting by people with arthritis. Findings support theory indicating that SRE is predictive in circumstances of greater challenge and agree with reviews outlining its importance in arthritis self-management. Funded by SSHRC grant #410-2005-2292.

Weight-Related self-discrepancies and shame, guilt, and pride emotional experiences

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Self-discrepancies between perceived actual and ideal self-state representations are associated with the elicitation of shame and guilt, whereas agreement between self-state representations are related to experiences of pride (Tracy & Robins, 2004). It is important to focus specifically on weight-related discrepancies and weight-related emotions given that a majority of women in Western cultures are dissatisfied with their weight and body shape (Frederick et al., 2006). Furthermore, weight dissatisfaction has been linked to negative physical, psychological, and social well-being in women (Swami et al., 2010). The associations between body-related actual:ideal self-discrepancies and shame and guilt have been examined (Bessenoff & Snow, 2006; McKinley, 1998) yet several shortcomings are noted in these studied: 1) the positive emotion of pride was overlooked, 2) did not focus on weight-related discrepancies and self-conscious emotions and, 3) used difference scores to examine self-discrepancies. To overcome these limitations, the aim of this study was to examine the associations between actual:ideal weight-related discrepancies and experiences of weight-related shame, guilt, and pride using self-discrepancy (Higgins, 1987) and self-conscious emotion (Tracy & Robins, 2004) theories as guiding frameworks. Women (N = 398; M = 29.4, SD = 14.4) completed self-report questionnaires. Main analyses involved the use of polynomial regressions and computation of response surface values. Actual and ideal weight self-perceptions were positively related to shame (R^2 = .22) and guilt (R^2 = .16). When the discrepancy between actual and ideal weight increased, shame and guilt also increased. There were no significant associations for authentic pride. Findings support a central tenet in the process model of self-conscious emotions such that perceptions of weight-related self-discrepancies may be important cognitive appraisals related to shame and guilt experiences. Further research is needed exploring the relations between self-discrepancies and pride.

Black cats and hockey tape: Examining the purpose of routines and superstitions among professional hockey athletes

Catsoulis, Stamata: York University

Wayne Gretzky, arguably hockey's best player ever, engaged in various routines and superstitions prior to every game. According to popular media, routines and superstitions in sport in general, and hockey in particular are commonplace, as athletes in various sports are known to develop routines and superstitions during their training and competition regimens. While

there is a growing body of sport psychology literature focused on pre-competition routines, there is less literature examining the role of superstitions in sport. This study critically examined the integrated and sometimes interchangeable role of routines and superstitions among professional hockey players. The key questions of this study were (a) how and why do ice hockey players employ routines and superstitions in their training, and (b) what effect do these routines and superstitions have on players' competition practices? Semi-structured interviews were conducted with seven former professional male hockey players. It was found that routines and superstitions influence competition anxiety, helping athletes obtain an optimal level of arousal for performance. In particular, routines and superstitions appear to provide a sense of comfort to help athletes cope with pre-competition anxiety. Participants often used the terms of routines and superstitions interchangeably; however, the understanding of these terms also differed between participants. These contradictions highlight the complexity of routine and superstitious behaviors, suggesting a need to re-examine the definitions of each term within academic literature. Further, the importance of routine and superstitious behaviors increased at higher levels of performance and at more important competitive events, indicating a need for additional research examining the longitudinal development of these behaviors.

Intrisic motivation while playing an exergaming platform in a group of sedentary children: Pilot study

Cebolla, Ausiàs; Universitat Jaume I; Alvarez, Julio; Consorcio-Hospital General de Valencia; Guixeres, Jaime; Universitat Politécnica; Lisón, Juan F., Universidad Cardenal Herrera-CEU; Escobar, Patricia; Universitat de Valencia

Physical inactivity has been identified as an important public health concern for children and adolescent. An increasing sedentary way of life is directly related to obesity; hence, prevention and management of childhood obesity are commonly based of lifestyle interventions wherein nutrition, physical activity (PA) and behavior modification are the main targets. The use of active games (exergames) can be useful in promoting PA. New approaches must address the promotion of PA in sedentary children. In recent years, active video games or Exergaming have been developed, whose objective is the use of the player's body in the game. It is expected that this platforms will increase the motivation because it mixes traditional video games with PA. The aim of this study is to analyze the effect of Exergaming platform on the intrinsic motivation in a sample of sedentary children, compared to active children. The sample was composed by 62 children (mean age = 11.4), 30 with active habits and 20 with sedentary lifestyle. All the participants participate in a walking at speed of 5 km / hr for 6 min in the traditional way (treadmill), and a walking at average speed of 5 km / hr during 6 min of a platform supported of exergaming (Exergame). Participants were randomized to start in the treadmill condition or in the treadmill + exergaming condition, in a counterbalanced study. Intrinsic motivation was measured with the Intrinsic Motivation Inventory (IMI, McAuley, Duncan & Tammen, 1987). An ANOVA test 2 (Exergame vs. treadmill) × 2 (sedentary vs. active) was used to test the different motivation after each condition. Results shows that sedentary children scored higher in the factor Effort/Importance of the IMI after the treadmill condition, compared to Exergame condition, but active children scored similar ($F(1,61 = 5.677$; $p = .021$). The results suggest that this platform can be useful to increase the intrinsic motivation in children with sedentary lifestyle. The results are in line with studies that suggest that exergaming platforms may be an interesting clinical tool to promote PA.

Measuring paternalistic leadership style: Initial measurement development and validation

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Adopting Cheng and colleagues' paternalistic leadership (PL) framework (Cheng, Chou, Wu, Huang, & Farh, 2004; Farh & Cheng, 2000), the purpose of this study was to develop a sport-specific paternalistic leadership measure and examine its' reliability and validity. Study 1 utilized qualitative interview with sport psychologist, administrator, athlete, and coach produced item pool and made a 30-item Paternalistic Leadership in Sport (PLS) draft. Study 2 administered PLS to 304 male adolescent athletes (M_{age} = 16.50, SD = ±0.86). With item discrimination analysis, exploratory factor analysis (EFA), and Cronbach's alpha coefficients analyses, Study 2 yielded a new 18-item PLS measure with 3 factors named "benevolence leadership, morality leadership, and authoritarianism leadership," and Cronbach's alpha ranging from .70 to .88 with total accounted variance of 56.08%. Study 3 administered 18-item PLS to 195 adolescent athletes (males = 120; females = 75; M_{age} = 16.44, SD = ±1.41). By using confirmatory factor analysis (CFA), this study found 18-item PLS with good indices of fit, Cronbach's alpha ranging from .74 to .91 with total accounted variance of 58.21%. Also, criterion related validity analysis found morality and benevolence leadership negatively correlated with all subscales of Athlete Burnout Questionnaire (ABQ, Radeke & Smith, 2001), but authoritarianism leadership only positively correlated with Reduced Sense of Accomplishment of ABQ. This study suggested that newly developed PLS can be used in testing coach-athlete relationship, and examining how paternalistic leadership influences athletes' affect, behavior, and cognition in sport settings.

People with intellectual disabilities do not have positive affective after walking exercise

Chen, Chih-Chia; Ringenbach, Shannon D.R.; Kelsey, Allison; Arizona State University

Walking has been reported as the most popular physical activity (Temple & Walkley, 2003) and promotes physical benefits in people with intellectual disabilities (ID) (Stanish, 2007); however, the prevalence of exercise in people with ID is still low (Temple, 2007). The purpose of this study was to determine the psychological effect of walking exercise as measured by EEG resting frontal asymmetry. The psychological outcomes in people with ID can be measured by the neural circuit of affect in the anterior areas of brains. We are among the first to examine the relationship between exercise and affective responsiveness in people with ID. Resting EEG frontal asymmetry (F4-F3) was collected from twelve participants with ID to represent affective responsiveness pre and post a 20-min treadmill walking exercise at low to moderate intensity. During walking, heart rate and rate of perceived exertion (5-point Likert Scale) were measured to monitor the exercise intensity. In the current study, the decreased frontal asymmetry from pre-exercise (M = 0.078) to post-exercise (M = 0.073, p = .047) indicates that affect became more negative after walking exercise in persons with ID. Our finding is not consistent with previous research in the typical population who showed increased frontal asymmetry (e.g., positive affect) after low intensity exercise (Woo et al., 2010). Most importantly, because of their negative experience of feeling after exercise in persons with ID, motivation is more important to maintain exercise behaviors than the typical population. The recent preliminary study has shown that persons with Down syndrome (DS) walked more steps and showed more interest on a treadmill when listening to music than when not listening to music. And another study with persons with DS, their exercise expected outcomes were improved when pedaling at 35% faster rate than voluntary pedaling with the assistance of a mechanical motor. Therefore,

extra motivating factors, such as music, assistance, are needed to accomplish exercise and its related benefits in persons with ID.

The effects of weight monitoring on college students' exercise behavior and motivation

Cheng, Jen-Liang; Chen, Chein-Chi; Tzu-Chi University

We have shown that an extracurricular exercise program (EEP) assisted by automated measurement increased physical activity among college students. The students' intrinsic motivation for exercise, however, was not moved. Because college students are interested in weight loss and most of them use diet and exercise for weight loss. We'd like to know if weight monitoring may raise their intrinsic motivation for exercise. Seventy college students were recruited from classes taking health education course. Individual participant was delivered an EEP of 16-week brisk walk, which was engaged on running track and measured automatically, and rewarded with ten percent of the course's credit if the program's goal, 10 laps per week, was met. Individual energy expenditure for the EEP during the first 4 weeks was measured as a baseline. In the 5th week, pretest was carried out and participants were randomized into a test group ($n = 34$) and a control group ($n = 36$). From the 5th to the 14th week, each participant of test group was weighed once every two weeks (5 times) while no weight monitoring was applied to the control group. In the end of the 16th week, posttest was carried out. Tested measures were body mass index (BMI) and locus of causality for exercise (LCE). Males' and females' data were treated separately. There were thus four groups of subjects. Paired-*t* and *t* test were used for results analysis. At the end of this study, 9 males and 16 females of the test group completed the pretest, the post test, and the weight monitoring while 10 males and 16 females of the control group completed the pretest and the posttest. Results showed that: a) neither BMI nor LCE of each of the four groups was changed; b) test group's males consumed more energy for the EEP than control group's males did ($p = 0.008$) since the application of weight monitoring. We concluded that weight monitoring enhanced only male college students' exercise behavior but it could hardly affect college students' intrinsic motivation for exercise.

The effect of positive affect on building mental resilience and predicting performance and satisfaction among collegiate athletes

Chi, Likang; Chen, Kate; National Taiwan Normal University

The purpose of this study was to examine the broad-and-build theory (Fredrickson, 2002) in the sport setting. This study recruited 119 collegiate athletes (64 males and 55 females) to examine (1) the build-hypothesis in broad-and-build theory, the mediating effect of mental resilience between positive affects and performance and satisfaction in sport. And also examine (2) the mediating effect of positive affects between mental resilience and positive outcomes. The participants were asked to collect affective data thorough online questionnaire during a period of one month (Time 1), which was a month before the 2010 National Intercollegiate Athletic Games. Then athletes' mental resilience data was collected in Time 2, which was just before the National Intercollegiate Athletic games. Finally, athletes' positive emotion, self-rated performance and sport satisfaction were collected at Time 3, which was immediately after the National Intercollegiate Athletic Games. The results of this study indicated that: (1) In terms of examining the mediating effect of mental resilience between positive affect and performance and satisfaction in sport, results indicated that mental resilience had a mediating effect between long-term positive emotion experience and athletes' performance and satisfaction. (2) In terms of examining the mediating effect

of positive affect between mental resilience and performance and satisfaction in sport, results indicated that positive emotion played as a mediator when athletes' performance and satisfaction were predicted by mental resilience. In sum, the results of this study supported the broad-and-build theory and the hypotheses of "upward spiral" effect.

The association of physical fitness and cognition among college students

Chi, Lin, Ta Hwa Institute of Technology; Yang, Kao-Teng; Teng, Kuo-Kai; Wang, Yi-Chun; Chang, Yu-Kai; National Taiwan Sport University

Research has indicated that the cardio-respiratory function of physical fitness has positive effects on cognitive functions. However, physical fitness contains many different components, and the relationships between each component of physical fitness and its influences on cognitive functions are less often explored. Therefore, the purpose of this study was to explore the relationship between the various components of physical fitness and cognitive functions. This study included 200 college students (mean age = 18.87 ± 0.84 years) who have completed physical fitness assessments including the body mass index (BMI), cardio-respiratory function (Male: 1600 meter running; female: 800 meter running), flexibility (sit-bend), power (standing long jump), and muscle endurance (one minute sit-ups). Cognitive function was assessed within two weeks after the completion of the physical fitness assessment. The Stroop Tests (Stroop Congruent, Stroop Color, Stroop, Natural, and Stroop Incongruent conditions) that represent information processing and executive functions were assessed. Results from the Pearson correlation showed that cardio-respiratory function was positively associated with the performance of incongruent conditions (r = .24). Negative associations have been observed between power and the performance of the Stroop color (r = -.17), Stroop congruent (r = -.19) and natural (r = -.16) conditions. In addition, the flexibility and the performance of the Stroop congruent condition is negatively correlated (r = -.153). In conclusion, our results are consistent with previous studies reporting the positive association between cardiovascular fitness and inhibition ability, but it also further pointed out that there are positive associations between other components of physical fitness and specific cognitive functions.

Bringing Pilates off the mat: Redefining women's healthy bodies through functional movement

Clark, Marianne

Girls' and women's low levels of engagement in physical activity have long been of interest to exercise psychologists and feminist researchers. Scholars have sought to understand women's experiences in conventional fitness centers using concepts such as self-efficacy and social physique anxiety to explain participation rates (Ginis, Jung, & Gauvin, 2003; Brewer et al., 2004; Prichard & Tiggemann, 2008). Others have examined women's' participation in traditionally feminine activities such as aerobics and critiqued the emphasis on a thin bodily aesthetic (Markula, 1995). However, much of this research focuses on the utilitarian aspects of physical activity (i.e., it can lower risk of obesity and chronic disease), as well on what the body looks like, rather than bodily experiences. Mindful fitness pursuits such as Pilates may provide important insights into a more embodied approach to health and movement. Methodology This qualitative ethnographic case study (Stake, 1995) explores the experiences of women who practice Pilates regularly at a small studio in Alberta. The author engaged in an advanced Pilates class for one year and conducted informal and formal

interviews with all 9 women in the class. Research questions included: How do women who practice Pilates regularly define health? How do they develop relationships with their body through regular Pilates practice? Does Pilates have potential to challenge our everyday understandings of the "healthy" female body? Results revealed 4 prominent themes that describe how Pilates practice enhanced bodily functionality and made everyday activities easier, an effect participants labeled "bringing it off the mat." Participants also noted that through the bodily practice of Pilates they were able to achieve a greater integration of mind-body awareness and expressed feeling strong both mentally and physically. None of the participants cited body shape size or disease prevention as a motivator or an effect of Pilates participation. Instead, they expressed how Pilates allowed them think more broadly about fitness.

Appearance commentary as a moderator between social physique anxiety and physical activity

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Social physique anxiety (SPA) has been identified as both a barrier (Carron & Prapavessis, 1997; Treasure, Lox, & Lawton, 1998) and a motivator (Frederick & Morrison, 1996) to participate in physical activity (PA). The inconsistencies that exist in this relationship suggest there may be other factors that account for these differences. The purpose of this study was to examine if appearance commentary (AC), which is any negative or positive verbal feedback received regarding one's physical appearance (Stormer & Thompson, 1996), moderated the relationship between SPA and PA among college-aged women. Participants ($N = 101$) completed a series of questionnaires used to assess their SPA, frequency of negative and positive AC, and self-report PA levels. A hierarchical multiple regression analysis was conducted to predict vigorous/moderate PA levels with SPA as the predictor variable and negative AC and positive AC as the moderators. Results showed the overall model was significant, accounting for approximately 13.5% of the variance in vigorous/moderate PA (F (3, 97) = 5.048, $p = .00$, R^2 adjusted = .11). The SPA/AC interaction term accounted for additional significant variance in predicting vigorous/moderate PA levels (delta $R^2 = .053$, $p = .05$), indicating that verbal commentary was a moderator. Further investigation indicated that a significant interaction with SPA only existed for the frequency of negative AC. Therefore, post-hoc analysis was only continued with the negative AC interaction term. Simple slope analysis indicated both high frequency of negative AC ($t = 2.147$, $p = .034$) and low frequency of negative AC ($t = 2.147$, $p = .034$) were significantly and negatively related to vigorous/moderate PA. The results indicate that negative AC had a greater effect on predicted values of vigorous/moderate PA levels for women who had high levels of SPA compared to women who had low levels of SPA. Future studies should examine the perceived effect of AC to determine whether the effect of the comment is a better moderator of the relationship between SPA and PA.

Automatic and controlled motivational processes regulate daily sedentary behavior

Conroy, David E.; Maher, Jaclyn P.; Doerksen, Shawna E.; Elavsky, Steriani, Pennsylvania State University

Sedentary behavior (SB) has been linked with increased risk for all-cause mortality, colon cancer, and chronic diseases (e.g., cardiovascular disease, metabolic syndrome, type-2 diabetes). Dual-process theories of motivation suggest that this behavior may be regulated

by a combination of automatic and controlled processes. SB is embedded in many aspects of everyday life so we expected that habit strength would be an important regulatory influence. Controlled efforts to limit SB (e.g., intentions) may serve as a counterweight to those automatic processes. Accordingly, we hypothesized that SB would be regulated by both automatic (i.e., habit) and controlled (i.e., intentions) motivational processes. Furthermore, we hypothesized that intentions to limit SB would exhibit both time-invariant (i.e., between person) and time-varying (i.e., within person) influences on daily SB. We conducted a daily diary study to test these hypotheses. College students ($N = 63$) completed the Self-Report Habit Index (adapted to focus on sitting) during an initial lab visit and, beginning that evening and continuing for 14 consecutive days, provided daily reports of sitting time and intentions for limiting sitting time during the following day. Multilevel linear modeling analyses indicated that a moderate amount of between-person variation existed in both intentions to limit SB (53%) and reported SB (43%). At the between-person level, people with stronger sedentary habit strength ($b = 37.43$, $p < .01$) and weaker overall intentions to limit sedentary time ($b = -1.36$, $p < .01$) reported spending more time sitting on average. At the within-person level, daily sitting time was associated with previous-day sitting time ($b = 0.15$, $p < .01$) and daily intentions to limit sitting time ($b = -1.57$, $p < .01$). These findings supported our dual-process theory of SB motivation. Both automatic and controlled processes should be targeted in interventions to reduce SB.

Physical education motivation regulation growth models across the transition to middle school

Cox, Anne E., Illinois State University; Ullrich-French, Sarah, Washington State University; French, Brian F., Washington State University

Self-determination theory (Ryan & Deci, 2007) explains a process of internalization of extrinsic motives, and the alternative shift away from intrinsic motives as external contingencies become more salient. As students enter middle school, changes in social climate (Barber & Olsen, 2004; Wigfield & Eccles, 2002) represent an opportunity to observe shifts in motivation. Few longitudinal studies have examined growth models of motivation regulations (Ntoumanis et al., 2009), especially during the transition to middle school. This study examined changes in motivation regulations of students as they entered middle school and across their middle school years. Fifth (44%) and sixth grade students ($N = 238$; 53% female) completed questionnaires for three consecutive years on motivation, psychological need satisfaction and social-contextual variables in physical education. Multilevel modeling was conducted with level 1 as repeated observation of motivation regulations and level 2 representing the nesting within students. Between-person variation in intercept and growth trajectories (slope) was examined first, followed by examination of predictors of between-person variations. Intrinsic motivation (intercept = 3.42, $p < .01$) and identified regulation (intercept = 3.29, $p < .01$) both started moderately high and declined significantly ($\beta = .10$ and .09, respectively, $p < .01$). Introjected (intercept = 2.81, $p < .01$) and external (intercept = 2.18, $p < .01$) regulations both started at a moderate level, but only external regulation had a significant slope ($\beta = .11$, $p < .01$), increasing over time. We proceeded to examine predictors of the remaining variability ($p < .01$) in intercepts and slopes. Significant predictors of between-person variance were gender and relatedness perceptions, but with varied results across motivation regulations. Results illustrated an increased reliance on external contingencies for physical education participation across the

middle school years and feeling socially connected in class appears central to explaining between-person variability in motivation.

"All for one": Examining the effects of cohesion and groupness on adherence in structured exercise settings

Crozier, Alyson J.; Spink, Kevin S.; University of Saskatchewan; Wilson, Kathleen S., California State University, Fullerton; Ulvick, Jocelyn D.; Priebe, Carly S., University of Saskatchewan

Group cohesion is one group construct that has been established as having a positive relationship with exercise adherence (Carron, Hausenblas, & Mack, 1996). Recently, groupness, which captures the degree to which a collection of individuals is perceived as a "group" by an individual member, also has been found to be positively associated with exercise adherence (Spink et al., 2010). Given that cohesion and groupness have been positively related in other settings (Ip et al., 2001), the purpose of this study was to examine the unique and combined effects of these two group variables on the prediction of exercise adherence. Specifically, we were interested in whether groupness would contribute unique variance beyond that explained by cohesion. Participants ($N = 102$) completed a questionnaire assessing cohesion (modified GEQ; Carron & Spink, 1992), groupness (Spink et al., 2010), and attendance in a self-identified exercise class in the last month. Consistent with past research, results from the first step of the hierarchical regression revealed that cohesion (ATG-Task) was positively associated with adherence, F (1, 100) = 4.9, $p < .05$. The addition of groupness on the second step explained an additional 12.5% of the variance, F change (1, 99) = 15.0, $p < .001$. Examination of the beta values in the full model, which was significant, F (1, 99) = 10.3, $p < .001$, R2 = .172, revealed that groupness was the only significant predictor of adherence ($\beta = .38$, $p < .001$). These findings are important for two main reasons. First, the fact that groupness added unique variance to exercise adherence suggests that researchers may wish to include it in future research examining the relationship between group constructs and exercise adherence. Second, the impact of cohesion perceptions on adherence was diminished when groupness was added to the model, suggesting that the relationship between these two variables may not simply be additive. Future research could examine this suggestion by testing models that capture different relationships between these two predictors (e.g., interactive).

"Monkey see, monkey do": Investigating the behavior of others on individual effort in sport

Crozier, Alyson; Spink, Kevin S.; Robinson, Blair; University of Saskatchewan

Evidence suggests that normative beliefs can have an effect on behavior (Cialdini, 2007). In the activity setting, it has been found that the perceptions of others' behavior was positively associated with individuals' exercise behavior (Priebe & Spink, 2010). This has been extended to sport where descriptive norms about others' effort were found to influence individual effort beyond that predicted by personal reasons (Robinson et al., 2011). As norms refer to assessments of others' behavior, what is it about the reference group that makes the normative information salient to the receiver? Based on the existing literature, two possibilities are personal (e.g., in-group vs. outgroup) and contextual (environment). The purpose of the study was two-fold. 1. To examine whether athletes' effort would be impacted more by norms from members of the same team versus other teams (contextual). 2. If context emerged as salient,

to determine whether friends on one's team or teammates are better able to predict effort above personal reasons. Athletes ($N = 50$) completed a survey assessing personal reasons (e.g., improves ability) for working hard during the season, normative beliefs about other groups' effort (Robinson et al., 2011), and their own effort levels (Bruner & Spink, 2011). In terms of context, regression results revealed that athlete's perceptions of how hard their teammates were working predicted individual effort, $F(2, 47) = 3.7$, $p < .05$, accounting for 13.7% of the variance, whereas perceptions of how hard athletes on other teams were working did not. Controlling for context, hierarchical regression results indicated that descriptive norms within the team predicted effort above personal reasons, F change$(2, 45) = 4.2$, $p < .05$, R^2 change = .12, but examination of the beta values revealed it was only the perception of the effort level of friends that was significant ($\beta = .42$, $p < .05$), not teammates ($\beta = -.08$, $p > .05$). These results suggest that both contextual and personal salience may be factors to consider when considering the reference group used for normative messages.

Sport imagery ability predicts trait confidence and anxiety intensity and direction

Cumming, Jennifer; School of Sport and Exercise Sciences; Williams, Sarah E.; University of Birmingham

The present study examined the interplay between cognitive (skill and strategy) and motivational (goal, affect, and mastery) imagery ability, trait competition confidence and anxiety. 314 athletes (181 male, 134 female; mean age = 19.2 years) completed the Sport Imagery Ability Questionnaire (Williams & Cumming, 2011) and Competitive Trait Anxiety Inventory-2D (CTAI; Jones & Swain, 1995). The hypothesized structural model was tested with maximum likelihood estimations using AMOS 19.0 (Arbuckle, 1999) and showed a good fit to the data ($\chi^2(407) = 659.84$, $p < .001$; CFI = .94; TLI = .94; SRMR = .06; RMSEA = .04). After removing non significant paths, goal and mastery imagery ability positively predicted confidence, which in sequence, positively predicted directional interpretations and negatively predicted intensity of symptoms associated with cognitive and somatic anxiety. A direct (positive) relationship was also found between affect imagery ability and cognitive anxiety intensity. These results further reinforce the need for separately assessing different types of imagery ability because significant predictions were only evident for motivational but not cognitive types. Specifically, athletes who can more easily image achieving goals and persisting during difficult situations are more likely to have greater confidence and reduced anxiety, and view their anxiety symptoms as facilitative towards their performance. Furthermore, a greater ability to image positive feelings and emotions may lead to generally experiencing more worries about an upcoming performance. However, Williams and Cumming (in press) have previously found this imagery type to also positively predict challenge appraisals of stressful situations. Taken together, these findings suggest that the increased cognitive anxiety intensity in those with higher affect imagery ability might be used as a stimulant to performance.

Early season sport-based social interactions and athlete burnout and well-being

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Positive social interactions (PSI), or social support, from sport-based social actors have shown negative associations with athlete burnout and positive associations with markers of well-being (Cresswell, 2009; Hollembeak & Amorose, 2005; Raedeke & Smith, 2004). Less attention has been paid to negative social interactions (NSI) in relation to these outcomes, despite evidence of their importance in sport (Udry, Gould, Bridges, & Tuffey, 1997).

Examining if NSI predict burnout and well-being beyond PSI will enhance the knowledge base on perceived athlete social interactions and contextually relevant psychological experiences. The purpose of this study was to examine associations of early season PSI and NSI with athlete burnout and well-being. It was hypothesized that perceptions of NSI would positively predict athlete burnout and negatively predict well-being beyond PSI. In addressing this hypothesis we also accounted for athlete stress perceptions because demands associated with vigorous early season training were expected to associate with athlete burnout and well-being perceptions. American collegiate swimmers ($N = 101$; $M_{age} = 19.5$ years) completed reliable and valid online assessments of study variables in the first month of the competitive season. Hierarchical multiple regression analyses showed PSI to negatively predict burnout ($p < .001$) and positively predict well-being ($p < .001$). NSI positively predicted burnout ($p < .05$, R^2 change = .05), but not well-being, beyond PSI. PSI and NSI collectively explained 26% of burnout variance and 23% of well-being variance, respectively. Moreover, the results showed perceived stress to mediate the association of NSI with burnout. The results highlight the importance of considering NSI when seeking to understand the psychological experiences of athletes. They also add to the knowledge base on athlete psychosocial experiences by showcasing the importance of early season social interactions to athlete burnout and well-being perceptions.

The relationship between appearance self-schema and self-determined exercise motivation

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To increase the effectiveness of any physical activity intervention, the determinants of exercise must first be understood (Dishman, 1994). Research has demonstrated that the "self" is an important determinant of exercise. An appearance self-schema is a cognitive representation that guides behaviors, cognitions and inferences associated with the meaning, importance and influence of one's appearance (Markus, 1977). Schemas contain an affective component (positive and negative) as well as representations of current and possible selves (Markus & Nurius, 1986). These affective components drive motivation to either attain or avoid certain self-conceptions (Garcia & Pintrich, 1994). Given that appearance plays a motivational role in exercise behavior, understanding how appearance self-schemas are related to exercise motivation may be important to enhancing exercise behavior. Therefore, the purpose of the study was to examine whether appearance self-schemas predict self-determined exercise motivation. Appearance self-schemas are measured with two dimensions. Self-evaluative salience reflects the extent to which one defines or measures themselves and their self-worth by their physical appearance. Motivational salience reflects the extent to which one attends to their appearance and engages in appearance-management behavior (Cash et al., 2004). Regular female exercisers ($N = 104$, aged 17-25) completed the Appearance Schemas Inventory (Cash et al. 2004) and the Behavioral Regulation in Exercise Questionnaire-2 (Markland & Tobin, 2004). Regression analysis revealed that self-evaluative salience predicted 19.2% of the variance of introjected regulation, while motivational salience predicted 7.5% of identified regulation and 5.8% of intrinsic regulation. These results extend previous research that has examined exercise motivation and appearance related cognitions (Hall et al., 2010). Those who are appearance schematic may be more motivated to exercise by both positive and negative factors of appearance than those who are appearance aschematic.

Daily fluctuations in self-efficacy and physical activity

Doerksen, Shawna E.; Elavsky, Steriani; Maher, Jaclyn P.; Hyde, Amanda L.; Conroy, David E.; Pennsylvania State University

Self-efficacy has been consistently shown to be related to physical activity (PA) behavior, change and maintenance of change. However, most of the research has examined self-efficacy at the between-person level (people who have higher self-efficacy than others). Although self-efficacy has been shown to be modifiable through interventions, little research has been done to determine if there are natural fluctuations in self-efficacy levels over short time periods that correspond to subsequent fluctuations in PA. We hypothesized that daily fluctuations in self-efficacy would be related to daily fluctuations in subsequent PA behavior and that, on average, people with stronger self-efficacy over time would report greater physical activity. University students ($n = 64$) completed a 14-day daily diary study in which, at the end of each day, they reported their PA behavior for that day and ratings of self-efficacy for engaging in moderate and vigorous PA the following day. Self-efficacy for moderate and vigorous PA had moderate between-person variation (ICCs ranged from .29 to .48). In a multilevel linear model, there was also a trend for stability in PA from one day to the next ($b = 0.01$, $p = .06$). Daily self-efficacy ratings predicted the following day's PA ($b = 0.38$, $p < .001$) and this effect was uniform across people ($\sigma^2 = 0.04$, $p > .50$). Additionally, people's average level of self-efficacy across days significantly predicted their overall level of PA ($b = .53$, $p < .001$). Thus, self-efficacy was positively related to PA at both the between- and within-person levels. These findings extend our understanding of the self-efficacy-PA relationship. This relationship has a dynamic component that has been understudied to date. That self-efficacy and PA varied daily and that the effect was uniform across people may have implications for intervention work. Not only should we be trying to increase people's overall levels of self-efficacy for PA, but also it may be helpful to promote daily self-efficacy to improve PA compliance.

Steps to health enhancing physical activity: Modeling the process of behavior change

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Not only in Germany but increasingly also in China there is a huge prevalence of the risk factor "Physical Inactivity" among the adult population. The Project "Activity behavior and behavior change of adults in an intercultural perspective", which is supported by China Scholarship Council (CSC) and Germany Academic Exchange Service (DAAD) from 2009 to 2011, is to construct a health enhancing physical activity-specific model to describe and explain the process of behavior change and most critical correlates influencing behavior change. Based on stage models like Transtheoretical Model (TTM) and Health Action Process Approach (HAPA), the FIT Model proposed in this project differentiates six stages of physical activity change: 1 Not Considering, 2 Considering, 3 Preparing, 4 Exploring, 5 Fluctuating and 6 Maintaining. Meanwhile, FIT model describes the most relevant psychosocial mediators. These are barriers, self-efficacy, outcome expectations, body concept, planning, affective attitudes and intrinsic motivation on the side of the person, as well as assessment of activity situation, activity emotion and social support on the side of the context. In addition, FIT model include also relevant health status such as physical correlates (fitness, risk factors) as well as psychosomatic correlates (complaints, health satisfaction, wellbeing). By cross-sectional study design, data was gathered from China and Germany with $n = 2082$, age

27-55, 57% female, 58% Chinese, 65% higher education. The results revealed that 1) there were significant differences between the stages of non-activity (1-3) and activity (4, 5, 6) concerning energy consumption (kcal) by physical activity on the one hand and concerning health status (fitness, complaints, health satisfaction and wellbeing) on the other hand. The validity of stage assessment in FIT model is supported; 2) barriers, self-efficacy, affective attitude and social support can significantly discriminate between adjacent stages and predict behavior change. It is acceptable to design stage-specific intervention in the future.

The effects of a self-regulation intervention on the stress, burnout, and well-being levels of student athletes

Dubuc, Nicole; Durand-Bush, Natalie; University of Ottawa

Student athletes' high levels of stress and difficulties coping with demands increase their risk of burnout and can overshadow the positive outcomes associated with sport participation (Gould & Whitley, 2009; Kimball & Freysinger, 2003). Due to negative personal and academic repercussions linked to burnout (Dubuc, Schinke, Eys, Battochio, & Zaichkowsky, 2010), research on potential interventions to prevent and reduce burnout is warranted and remains scarce (Goodger, Gorely, Lavallee, & Harwood, 2007). The purpose of this study was to investigate the implementation of a person-centered, feel-based self-regulation intervention with university student athletes experiencing burnout and determine its effect on their levels of stress, burnout, and well-being. Four male and four female athletes competing on hockey, basketball, swimming or fencing teams and completing their 1st, 2nd, 3rd or 4th academic year took part in a season-long intervention involving 8 to 10 biweekly individual sessions with a trained consultant and self-reflective journaling. Predominant themes addressed in the intervention were stress (i.e., perceptions of imbalance between demands and resources), coping, emotions, and self-regulation strategies. The athletes were selected from a sample of 147 varsity student athletes based on their moderate to high burnout scores on the Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001). The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983), the Short Version of the Self-Regulation Questionnaire (Carey, Neal, & Collins, 2004), the Warwick-Edinburgh Mental Well-Being Scale (Tennant et al., 2007), and the ABQ were administered four times throughout the season to assess the effects of the intervention. Repeated measures ANOVAs revealed that despite changing at varying rates, stress and burnout levels significantly decreased and well-being and self-regulation levels significantly increased as the intervention progressed ($p = 0.05$). Implications for future research and interventions with this population will be discussed.

Cognitive skills and physical exertion for dismounted soldiers

Dyrlund, Allison

Tactical decision-making in the military is most often trained in a controlled, classroom environment. However, tactical decisions are not made in a sterile environment. Dismounted Soldiers are required to engage in complex decision making and other cognitively demanding tasks while carrying heavy loads on foot. Research has shown that physical exertion, like that experienced by dismounted Soldiers, affects cognitive skills. The nature of the effect, however, varies greatly depending on exertion factors (intensity, mode, duration) as well as cognitive task factors (type of task, point of administration). The purpose of this paper is to integrate insights from research across various domains to identify the psychological constructs of the decision-making process that may be hindered by the types of physical

exertion a Soldier will experience in the tactical environment. Conclusions from this paper will lend to empirical testing to determine the appropriate training methods to mediate the effects of physical exertion on decision making in tactical environments.

Is gait a predictor of cognitive differences in older adults?

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Previous research suggests that there is a significant link between cognitive ability and gait. The purpose of this study was to examine the relationship between cognitive processing speed and gait. Specifically, we hypothesized that decreased speed on three cognitive processing tasks (reaction time, letter comparison, and picture comparison) would be associated with abnormal locomotion. Twenty-nine older adults (18 females, 11 males), age 55 to 92 (M = 75.54, SD = 7.87) were recruited from a cohort of older individuals taking part in an exercise intervention through the Center for Healthy Living & Longevity at the University of Texas at Arlington. Spatial and temporal measurements of gait were collected using the GAITRite electronic walkway (CIR Systems Inc., NY). Three measures of mental processing speed (reaction time, letter comparison, and picture comparison) were employed to provide processing speed scores for the participants. Reaction time (RT) and letter comparison (LC) were not significantly correlated with any gait variables. However, the speed of response on the picture comparison (PC) task was significantly correlated with cadence (r = -0.50, p = 0.009), step time (L & R) (L; r = 0.37, p = 0.04 & R; r = 0.50, p = 0.008), and double stance time (L & R) (r = 0.37, p = 0.03). These findings indicate that those with reduced processing speed were taking slower, shorter steps (i.e., shuffling). Based on anecdotal self-report by the participants, the PC task was the most challenging. In this case, task difficultly may play a role in the relationship between gait and cognitive processing speed with more difficult processing speed tasks being more related to differences in gait. Therefore, gait may be a valuable tool for assessing cognitive changes associated with aging, but only for in the more challenging cognitive domains.

Behavioral regulation strategies in exercise in obese children and adolescent

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Obese children have shown to have lower physical activity levels and to be more sedentary than normal weight children. Some authors have highlighted the importance of understanding the motivational processes regulating exercise initiation and persistence. The "self-determination theory" conceptualization proposes that persistence behavior is regulated via mechanisms reflecting the quality of motivation toward a particular activity (Deci & Ryan, 1985). "Behavioral Regulation in Exercise Questionnaire-2 scale" (BREQ-2; Markland & Tobin, 2004) assess exercise regulations consistent with the "self-determination theory" and it is composed by 5 factors (Intrinsic, Identify, Introjected, External and Demotivation). The aim of this study was to evaluate the differences in the behavioral regulation strategies in physical exercise in a sample of overweight/obese children, compared to normal weight, using BREQ-2. The sample was composed by 135 children and adolescents, with age range between 12-16 years old. The normal weight (n = 83) sample was recruited from a summer school and the overweight (n = 36) sample from a Pediatric Unit specialized in the treatment

of obesity, both in Valencia (Spain). Participants fulfilled the BREQ-2. It was calculated the BMI *z*-score to classify children as normal weight and overweight/obese. A MANOVA was applied to analyze the differences between both groups, and results showed significant differences ($F(1,117) = 7,842$; $p < .001$). Specifically the overweight /obese children scored significantly higher than normal weight in external regulation ($F = 5,915$, $p < 0.05$), and in Introjected regulation ($F = 34,07$; $p < .001$). Correlational analysis showed that BMIz was negatively related with Intrinsic regulation ($r = -0.20$; $p < 0.01$), and positively related with Introjected regulation ($r = 0.382 < 0.000$) and external behavior regulation ($r = 0.283 < 0.000$). Results showed different regulation strategies according to BMI, suggesting that the strategies to improve physical activity should be different both samples.

Beyond self-esteem and narcissism: The contribution of young women's self-compassion to eudaimonic well-being

Ferguson, Leah J., University of Saskatchewan; Kowalski, Kent C., University of Saskatchewan; Mack, Diane E., Brock University; Sabiston, Catherine M., McGill University

Preliminary research with young women athletes and exercisers (Ferguson et al., 2011) suggests that self-compassion (i.e., being kind and understanding toward oneself in the face of pain and failure; Neff 2003) is related to striving for human potential consistent with eudaimonic well-being (Ryff, 1989, 1995). Given concerns regarding similarities between self-compassion, self- esteem, and narcissism (Leary et al., 2007; Neff, 2003, 2009), it seems prudent to consider the unique contribution of self-compassion to eudaimonic well-being. The purpose of this study was to explore if self- compassion explained unique variance beyond self-esteem and narcissism on eudaimonic well-being. Young women athletes and exercisers ($N = 125$; $M_{age} = 18.94$ years) completed an online survey of reliable and valid measures. Preliminary correlations revealed significant ($p < .05$) positive relationships between self-compassion and eudaimonic well-being ($r = .71$), self-compassion and self-esteem ($r = .68$), self-compassion and narcissism ($r = .22$), and self-esteem and narcissism ($r = .39$). Semipartial correlations between self-compassion and eudaimonic well-being were significant ($p < .01$) after controlling for the effects of self-esteem ($r = .27$), narcissism ($r = .66$), and both self-esteem and narcissism ($r = .27$). Study findings are in line with Leary et al. (2007) and Neff (2003) who suggested that self-compassion contributes to well-being (e.g., depression, anxiety) in ways that are distinct from those of self-esteem and narcissism. Self-compassion reflects a kinder and gentler orientation to oneself, encourages personal responsibility, and does not require the narcissistic illusions of self-esteem (Leary et al., 2007). However, future research is needed to consider the factors that might explain how self-compassion contributes to well-being specifically within the eudaimonic tradition, as well as contextualized to the sport and exercise domain. (Supported by the Social Sciences and Humanities Research Council of Canada; SSHRC.)

"Yes, we can!": Collective efficacy and athlete leadership in sports teams

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Collective efficacy can be defined as a group's shared confidence that they will successfully achieve their goal. We examined which behaviors and events are perceived as sources of collective efficacy beliefs in a volleyball context. In Study 1, volleyball coaches from

the highest volleyball leagues (n = 33) in Belgium indicated the most important sources of collective efficacy. This list was then adapted based on the literature and on feedback given by an expert focus group, resulting in a 40-item questionnaire. In Study 2, coaches and players from all levels of volleyball in Belgium (n = 2,365) rated each of these sources on their predictive value for collective efficacy. A principal component analysis revealed that the 40 sources could be divided into eight internally consistent components. Positive supportive communication (e.g., enthusiasm after making a point) was identified as the component that was most predictive for positive collective efficacy beliefs. A component referring to the negative emotional reactions of players (e.g., discouraged body language) was the most predictive for negative collective efficacy beliefs. At item level, the expression of collective efficacy by the athlete leaders on the field was rated by the coaches as most predictive for positive efficacy beliefs. Therefore, in Study 3 we focused on these athlete leaders. More specifically we explored the different leadership roles occupied by these athlete leaders, as well as their most important qualities. Furthermore we examined the impact of these leaders in affecting the efficacy beliefs of their teammates. In addition, we explored the role of team identification. These findings offer a starting point for the design of a continuous measurement of collective efficacy through observation.

Anticipation of direction in the cutting maneuver is not influenced by experience in ball games

Fujii, Keisuke, Kyoto University; Shinya, Masahiro, Tokyo University; Yamashita, Daichi, Kyoto University; Oda, Shingo, Kansai University; Kouzaki, Motoki, Kyoto University

Skilled ball game players are habitually trained to anticipate and react in quick response to a changing situation such as an opponent's cutting maneuver, while novice ball game players are assumed to lack this ability. However, one daily faces situations requiring anticipation of others' movements, such as avoiding a collision with others irrespective of the experience in ball games. Here we tested the hypothesis that reaction among the novices is inferior to that among the skilled players, whereas for anticipation among novice ball game players are similar to that among skilled ball game players. We first presented the skilled and novice players with video stimuli of a quick change in others' running direction and instructed the participants to anticipate and react by sidestepping. To estimate the timing of when the participants received information to make decisions on the others' running direction in a real-time situation, we subtracted the time needed for visuo-motor processing from the time when the participants react to the video clip. Our estimation indicated that the novices did not perceive the relevant cue later than the skilled players; however, the reaction time and total reach time for the novices were later than those for the skilled players. These results suggest that in a real 1-on-1 ball game situation, the novices should react using the uncertain information in a time lesser than the timing measured for them in the video because they relatively long time for sidestepping.

The relationship between self-regulation, psychological well-being, psychological stress, and burnout in a high-pressure performing context: What we can learn from physicians and medical students

Gagnon, Marie-Claude; Durand-Bush, Natalie, University of Ottawa

The purpose of this study was to investigate the self-regulation capacity of 37 medical students and 25 physicians involved in medical training at a Canadian university.

Seldom empirically examined as a psychosocial construct in the context of medicine, self-regulation is an important skill that allows performers to effectively plan, generate, and adapt their thoughts, feelings, and actions to meet personal standards and goals within their changing environment (Zimmerman, 2000). Our aim was to determine the relationship between self-regulation and well-being-related variables. To this end, the 62 participants (31 men, 31 women; age range = 21–70) completed four online questionnaires to measure self-regulation capacity (SSRQ, Carey, Neal, & Collins, 2004), psychological well-being (SPWB, Ryff & Essex, 1992), psychological stress (PSM-9, Lemyre & Tessier, 2003), and burnout (MBI, Schaufeli, Leiter, Maslach, & Jackson, 1996). Results showed that the medical students and physicians had high levels of self-regulation and moderate levels of psychological well-being, psychological stress, and burnout. Physicians had significantly higher levels of psychological well-being than medical students on the subscales of Autonomy, Personal Growth, Purpose in Life, and Self-Acceptance. Means for self-regulation capacity significantly correlated with all outcome variables and significantly predicted levels of psychological well-being, psychological stress, and burnout. Significant interaction effects were found for three subscales of psychological well-being; environmental mastery, purpose in life, and self-acceptance, suggesting that self-regulation capacity may benefit physicians but not necessarily medical students for these outcome variables. Self-regulation capacity appears to be an important skill that may help not only sport (Kitsantas, Zimmerman, & Cleary, 2000) but also medical performers to meet the stressful demands of their profession and maintain an adequate level of well-being. These findings will be discussed in relation to the sport literature and serve as an impetus for further research in this area to resolve the prevalent societal issue surrounding stress and burnout in high-pressure environments.

Examination of the psychometric properties of the Self-Presentational Efficacy in Exercise Scale

Gammage, Kimberley L., Brock University; Lamarche, Larkin, University of Toronto; Sullivan, Philip J; Gabriel, David A.; Brock University

Self-presentation refers to the process by which people attempt to monitor and control the impressions that others hold of them. People's confidence in their ability to successfully present these desired images is referred to as self-presentational efficacy. The Self-Presentational Efficacy in Exercise Scale assesses individual's confidence in presenting images of being, fit, coordinated, and physically attractive. However, little evidence of its validity and reliability is available. The present study examined the psychometric properties of the SPES. University students (196 men and 268 women) completed the SPES and measures of social physique anxiety, fear of negative evaluation, and physical activity. Participants completed the SPES a second time approximately two weeks later. A series of SEM analyses were conducted to examine SPES's factor structure. Confirmatory factor analysis indicated a very good fit for the hypothesized 3-factor model (men: CFI = .934, NNFI = .920, RMSEA = .089, SRMR = .053; women: CFI = .936, NNFI = .923, RMSEA = .087, SRMR = .045). Consistent with the hypothesized structure, the factors were labelled self-presentational efficacy expectancy, self-presentational outcome expectancy, and self-presentational outcome value. Analysis of gender invariance indicated the factor structure was invariant across sex (CFI = .916; NNFI = .907 RMSEA = .095; SRMR = .187). Acceptable internal consistencies (all $\alpha > .85$) and test-retest reliability for each subscale were found. Evidence of discriminant validity was demonstrated; men scored

higher on self-presentational efficacy expectancy compared to women. Regular exercisers scored higher on self-presentational efficacy expectancy and lower on self-presentational outcome value compared to non- or infrequent exercisers. Convergent validity was also shown, with self-presentational efficacy negatively related to social physique anxiety and fear of negative evaluation. Future research should assess the contribution of the three factors in predicting exercise-related outcomes.

Acute exercise and body image: The effect of yoga and resistance training

Gammage, Kimberley L., Brock University; Drouin, Breanne, Brock University; Lamarche, Larkin, University of Toronto

Poor body image is related to several negative outcomes, such as disordered eating behavior, poor self-esteem, depression and anxiety. Therefore, it is important to investigate ways to promote positive body image. One such way is through exercise; significant evidence exists that chronic exercise can improve trait body image (Campbell & Hausenblas, 2009), although less evidence exists on the effects of acute exercise on state body image. Further, correlational research suggests that yoga may be more related to positive body image than more traditional types of exercise (Daubenmeir, 2005; Prichard & Tiggemann, 2007). The present study examined the effect of two types of acute exercise classes (resistance training and yoga) on state body image attitudes. College-aged female non/infrequent exercisers (N = 40) completed state measures of body satisfaction, social physique anxiety (SPA), and appearance orientation (importance) prior to and following their participation in a single yoga and resistance class. Each class was approximately 30 min and designed for beginners. Classes were held one week apart, and the order of classes was counterbalanced. A series of 2 (class type) × 2 (time) repeated measures ANOVAs were conducted, with body satisfaction, SPA, and appearance orientation as the dependent variables. For SPA and body dissatisfaction, there were significant group × time interactions (F [1, 50] = 7.22, p = .01, η^2 = .126 and F [1, 50] = 6.38, p = .015, η^2 = .113 respectively); follow-up analyses showed that there was a significant decrease in SPA and body dissatisfaction following the yoga class, and no change following the resistance class. There were no effects for either class on appearance orientation. These findings indicate participation in a single yoga class may have positive effects on state body image attitudes in female non-exercisers. Types of exercise that focus on awareness and acceptance of body cues and sensations, without responding to those cues, may have the greatest positive impact on state body image.

Understanding social relational influences on adolescent motivation and sport participation: The Interpersonal Context in Sport Questionnaire

Garcia-Bengoechea, Enrique, McGill University; Sabiston, Catherine M., McGill University; Wilson, Philip M., Brock University

The aim of this study was to provide initial evidence of structural and criterion validity of scores derived from the Interpersonal Context in Sport Questionnaire (ICSQ), an instrument designed to offer a comprehensive assessment of perceived interpersonal influences on adolescent motivation and sport participation. Development and initial validation of the ICSQ included several iterations of data collection and analyses using three different samples of adolescent sport participants (total N = 670; mean age = 15.1 years). Confirmatory factor analysis supported the adequacy of a 43-item ICSQ measurement model consisting of 12 dimensions of perceived interpersonal influence consistent with the conceptual framework proposed by García-Bengoechea and Strean (2007). According to this framework, adoles-

cent sport participants see others around them as influencing their motivation in five major interrelated ways: (1) as providers of support; (2) as sources of pressure and control; (3) as sources of competence-related information; (4) as agents of socialization of achievement orientations; and (5) as models to emulate. Internal consistency reliability estimates for ICSQ sub scales scores reached or exceeded the value of $\alpha = 0.70$ in this sample. Higher scores on ICSQ dimensions posited to reflect positive influences were associated with greater enjoyment, perceived competence, and commitment in sport. Overall, these findings suggest that the ICSQ displays adequate psychometric characteristics and the use of the instrument may be informative for studying the complex social relational context of adolescent motivation and sport participation.

An investigation of the effects of energy conservation and motivation on self-regulation strength depletion

Graham, Jeffrey D.; Bray, Steven R.; Martin Ginis, Kathleen A.; McMaster University

When people control their thoughts, emotions, and behaviors they deplete a central nervous system resource termed self-control strength (Baumeister et al., 1998). Self-control strength depletion negatively affects self-control performance of exercise and other tasks with some moderating effects (Hagger et al., 2010). For instance, when people anticipate future self-control demands they conserve self-control strength (Muraven et al., 2006). Also, people exert more self-control when they are autonomously motivated to do so (Moller et al., 2006). However, the interaction of conservation and autonomous motivation on self-control has not been investigated. The purpose of this study was to investigate the independent and combined effects of conservation and autonomous motivation on self-control depletion. University students ($N = 72$) completed two maximum endurance isometric handgrip trials separated by the Stroop task and two manipulations. After the first handgrip squeeze and prior to the Stroop, participants were randomized to a conservation (anticipation of future self-control) or control condition. Following the Stroop task, participants were further randomized to an autonomy support or control condition. As expected, participants who anticipated future self-control depletion conserved resources and completed fewer words on the Stroop task ($F(1,70) = 11.68$, $p = 0.001$, $d = 0.80$). However, conservation was not associated with better handgrip endurance ($F(2,69) = 0.08$, $p = .774$, $d = 0.07$). Autonomy support was associated with better handgrip performance ($F(2,69) = 6.61$, $p = .012$, $d = 0.62$). There was no evidence of an interaction between conservation and autonomy support. Findings suggest that when people anticipate future self-control of physical effort they conserve self-control resources and providing autonomy support helps people override self-control strength depletion to deliver greater physical effort and performance.

It wears me out just imagining it! Effortful imagery leads to diminished physical endurance performance

Graham, Jeffrey D.; Tran, Alexander; Bray, Steven R., McMaster University

The beneficial effects of mental imagery on performance have been observed for many types of physical tasks; however, the effects for endurance tasks are small and inconsistent (Driskell et al., 1994). Furthermore, imagery has been shown to negatively affect physical performances under some conditions (Beilock et al., 2001). Mental imagery is a multisensory experience involving self-control of movement sensations as well as thoughts and emotions associated with those movements. Self-control strength is a limited resource that is depleted when people exert control over impulses, emotions, thoughts, and behaviors (Baumeister et

al., 1998). When self-control strength is depleted by one task, subsequent performances on tasks requiring self-control are negatively affected (Hagger et al., 2010). The purpose of this study was to investigate the effect of mental imagery on physical endurance. We reasoned that mentally imaging a highly effortful task should deplete self-control strength and impart negative effects on subsequent performance of an effortful physical task. Participants performed two isometric handgrip endurance trials (50% of maximum contraction) separated by either an imagery manipulation or a quiet rest period. Following the baseline endurance trial, participants randomized to an imagery condition (n = 19) imaged themselves holding the handgrip squeeze for 3 min while resisting the temptation to quit, whereas participants in a control condition (n = 19) rested quietly for 3 min. Participants in both groups then performed a maximum endurance handgrip squeeze again. Residualized change scores were computed, controlling for baseline endurance performance. As expected, participants in the imagery group showed greater negative changes in performance than controls (F(1,37) = 5.83, p = .024, d = 0.77). Results imply that effortful imagery prior to an endurance task depletes self-control strength. Findings have implications for the timing of imagery relative to task performance, imagery content, and the type of task being performed.

Finnish adolescents' expectancy-value profiles, enjoyment, and directly measured physical activity in school physical education lessons

Grasten, Arto Juhani, University of Jyvaskyla

Physical activity (PA) offers significant health benefits. A large part of Finnish adolescents fail to accumulate at least 60 min of PA on a daily basis. Schools are an ideal setting for promoting PA, as schools can reach a full range of individuals in a population. The expectancy-related values are crucial factors in predicting adolescents' achievement outcomes, such as effort, persistence, performance, and choice in physical education (PE). Hence, exploring the associations between adolescents' expectancy-value profiles, and enjoyment, and directly measured PA in school PE lessons are of great value for promoting PA in PE, and overall PA. The specific aim of this study is to analyze the expectancy-value profiles based on the expectancy-value theory, and how these profiles are related to adolescents' PE enjoyment, and directly measured PA in PE lessons. The sample comprised 96 adolescents (58 girls and 38 boys) aged between 12 and 16 years (M = 15.03; SD = .94) from a secondary school located in Northeast Finland. Adolescents' beliefs about ability, expectancies for success, attainment values, intrinsic values, and utility values were measured by modified questionnaires developed by Xiang et al. (2003). To analyze PE enjoyment the Sport Enjoyment Scale was used. To analyze adolescents' directly measured PA, Polar activity monitors were used, which measured daily PA, ranging from moderate to vigorous PA. K-mean clustering method identified two expectancy-value profiles. Adolescents with the "high" expectancy-value profile had high beliefs about ability, expectancies for success, intrinsic values, and utility values, but low attainment values. In contrast, adolescents with the "low" expectancy-value profile had low beliefs about ability, expectancies for success, intrinsic values, and utility values, but high attainment values. The adolescents in the first cluster enjoyed PE lessons more and were physically more active in PE lessons. The results revealed that high expectancy-values were related to high enjoyment, and directly measured PA in PE lessons.

Imagery as a skill: Longitudinal analysis of changes in motivational imagery

Gregg, Melanie, University of Winnipeg; Hall, Craig, University of Western Ontario

Imagery intervention research indicates that athletes improve their imagery through practice (supporting imagery as a skill); others use imagery ability measures as a screening tool for their imagery intervention studies as they argue that athletes must have a minimal imagery ability level to benefit from the intervention (supporting imagery as an ability). If imagery is a skill, then it should only improve over time if athletes increase their use of imagery (i.e., engage in deliberate imagery practice). This assumption has typically not been examined; in imagery intervention studies all participants are encouraged to increase their use of imagery. To examine this assumption, 44 athletes vying for selection to a provincial track and field team to compete at a national multi-sport games completed the Sport Imagery Questionnaire (SIQ) and the Motivational Imagery Ability Measure for Sport (MIAMS). Thus, improvements in motivational imagery were the focus of the present study. The athletes were requested to complete the measures at four time intervals across eighteen months leading up to the games. The participant group was comprised of 24 females and 20 males, the majority competed at the national level ($n = 31$) with the remaining distributed across club, provincial and international levels. Repeated measures ANOVA indicated the athletes' used cognitive general imagery (i.e., images of race plans) more frequently just prior to the games. There were no other significant changes across the functions of imagery use as assessed by the SIQ. For motivational imagery ability, as assessed by the MIAMS, there was no significant change over time indicating the athletes' motivational imagery remained stable. These results add support for targeted imagery interventions as athletes do not spontaneously or independently begin to increase their use of imagery, and consequently improve their imagery skills.

Step up or step in: A stair use intervention in a university setting

Guerrero, Michelle D.; Loughead, Todd M.; Munroe-Chandler, Krista J., University of Windsor

In 2011, only 17% of adult Canadians reported being physically active (Colley et al., 2011). This high rate of inactivity may be due to the misconception that any health benefits from physical activity can only be gained through strenuous sustained aerobic activity (Carron et al., 2003). However, recent studies have reported health benefits when individuals accumulate physical activity throughout the day (Dunn et al., 1998; Jakicic & Wing, 1995). One opportunity for accumulating incidental, inexpensive, and accessible physical activity is to recommend stair use instead of escalators or elevators. Previous research conducted in the United States and United Kingdom has shown that stair use significantly increased with the presence of poster prompts (Blamey et al., 1996; Brownell et al., 1980; Kerr et al., 2001). The purpose of this study was to examine the effectiveness of a signed intervention to promote the use of stairs in a Canadian university setting. Stairway and elevator use of individuals were observed and recorded during two, one-week phases. The first phase was the observation of individuals when no sign was present. The second phase of the study included placement of a sign at the elevator encouraging individuals to take the stairs accompanied with an arrow directed at the stairway. A total of 2,654 observations were made. It was hypothesized that a sign encouraging stair use with an arrow pointing towards the location of the stairs would be more effective in increasing stair use more than when no sign was present. Logistic regression analyses indicated a small but significant increase (3.8% units, OR .84, 95% CI .72 to .99, $p < .05$) in stair use from baseline to intervention. Results are discussed in terms of their implications concerning field interventions and the promotion of regular physical activity among less active individuals.

Construct validation of scores from a modified version of the Psychological Need Thwarting Scale

Gunnell, Katie E.; Crocker, Peter R.E.; University of British Columbia; Mack, Diane E.; Wilson, Philip M.; Brock University;

Deci and Ryan (2002) theorized that psychological need satisfaction contributes to well-being whereas need thwarting contributes to ill-being. However, few investigations have examined aspects of psychological need thwarting in physical activity contexts. Bartholomew, Ntoumanis, Ryan, and Thørgersen-Ntoumanis (2011) recently developed the Psychological Need Thwarting Scale (PNTS) to assess perceived need thwarting in sport contexts. The purpose of this investigation was to examine aspects of construct validity of scores derived the PNTS modified to physical activity contexts. Participants (N = 157, M_{age} = 37.70 years; SD = 19.88 years) completed identical questionnaires at two time points separated by 6 months. Structural evidence of scores was calculated through confirmatory factor analysis (CFI = .92 and .93 RMSEA = .066 [90% Confidence Interval = .040-.090] and .073 [90% Confidence Interval = .073 .049-.096] at time 1 and time 2, respectively). Discriminant evidence of score validity was calculated through bivariate correlations between scores on psychological need satisfaction and need thwarting (rs ranged from -.05 to -.59). Results of this study provide additional support for the distinction between psychological need satisfaction and thwarting (Bartholomew et al., 2011). A high inter-factor correlation was found between competence and autonomy thwarting. While limitations were noted, scores from the modified version of the PNTS in this study appeared to demonstrate initial evidence of construct validity. The modified version of the PNTS may be a useful self-report instrument to assess perceptions of psychological need thwarting in physical activity contexts.

Imagery on the fly: Imagery use by physical educators

Hall, Nathan D., University of Winnipeg; Hickson, Clive N., University of Alberta; Melnychuk, Nancy, University of Alberta; Tobin, Danielle, University of Western Ontario

Researchers have found that imagery is employed in many different professions to help with the performance of job related behaviors (Overby, Hall, & Haslam, 1999; Edwards, Sadoski, & Burdenski, 2005; Gregg, Clark, & Hall, 2008). However, there has been little research to date that has specifically examined the use of imagery by physical educators. Hall and Fishburne (2010) proposed that mental imagery is a skill that could be used by those in the physical education teaching profession to aid in the effective performance of several teaching related behaviors and they promoted future research that would help create an understanding of this phenomenon. The present research was designed to serve as an initial investigation into the use of imagery by physical education teachers. Using a qualitative approach, 15 physical education teachers (Male = 7, Female = 8) presently teaching physical education in either junior high or high schools completed a one-on-one semi-structured interview regarding their use of imagery. All of the participants involved in the study indicated that they were presently using imagery to aid in their teaching of physical education. The results demonstrated that almost all of the participants in this sample were using imagery in an unstructured fashion (i.e., not planned) and many of the participants indicated that they commonly used imagery "on the fly" during physical education lessons or that imagery naturally occurred as part of their planning. Although the imagery was unstructured, most of the physical education teachers in this study perceived the imagery to be extremely beneficial. However, it appeared that the imagery being done

by these physical educators was much more likely to serve a cognitive function as opposed to a motivational function. A detailed examination of the results, practical implications of this study, and potential future research in this area will be discussed.

Testing postulates of the Developmental Model of Sports Participation: Is motivation moderated by play and practice during the sampling years?

Hendry, David T, Forthvalley College; Hodges, Nicola J, University of British Columbia; Crocker, Peter R.E., University of British Columbia

The Developmental Model of Sports Participation (REF) has been refined to produce a series of testable postulates. Of interest is the postulate that high amounts of deliberate play during the sampling years promotes intrinsic motivation through involvement in activities that are enjoyable. We tested elite Scottish youth soccer players (n = 156) aged 11-16 years across 3 different age groups. Participants provided demographic information, completed a retrospective practice questionnaire, the Behavioral Regulation in Sport Questionnaire and the Passion Scale. The groups showed similar practice/play profiles during the sampling years, spending ~45 % of their time in organized practice across all age groups. When we looked at the practice/play ratios as age increased (i.e., beyond the sampling years), as expected, organized practice increased in comparison to play. In general there was no evidence of any relationship between practice and play with markers of motivation. Analyses of data from youth players playing at U13, U15, and U17 age groups yielded no evidence that with increasing age, percent time in practice versus play during the sampling years shows a negative relationship with self-determined motivation. With advancing age, the only motivation related change was a trend for players to decrease in autonomously regulated motivation. Although not related to motivational regulation, a diverse exposure to a number of sports in the sampling years was positively related to passion (both harmonious and obsessive). We conclude that specialized, structured practice does not lead to players who are less intrinsically motivated than players who engage in relatively less practice and more play. It is acknowledged that these players had not reached adult elite levels and that intrinsic motivation might only be sensitive to relative amounts of play and practice as an adult player. However, there was no evidence for the hypothesized relationship between play/practice and motivation with increasing age.

Examining the impact of rule changes on the home advantage in the National Hockey League

Hoffmann, Matt D.; Loughead, Todd M.; Dixon, Jess C.; University of Windsor

The home advantage is defined as the finding that home teams in sport competitions win over 50% of the games played under a balanced home and away schedule (Courneya & Carron, 1992). While the home advantage in the National Hockey League (NHL) has consistently been reported at over 60% (e.g., Nevill & Holder, 1999; Schwartz & Barsky, 1977), there are no known studies examining the changes in the home advantage from regulation time to overtime and the shootout since rule changes were instituted by the NHL beginning with the 2005-2006 season. A regulation game consists of three 20-minute periods. If the game is tied following regulation time, a five-minute "sudden death" overtime period ensues to determine a winner. If the game is still tied after these 5 min, a shootout occurs to determine a winner. The purpose of the current study was to examine changes in the home advantage from regulation time, overtime, and the shootout. Archival data were collected for every regular season game that occurred between the 2005-2006 season to the 2010-2011 season

(N = 7,386). It was hypothesized that there would be a reduction in the home advantage as home teams progressed from regulation time to the shootout. Indeed, the results showed a decline in home teams' winning percentages as games proceeded from regulation (56.6%), to overtime (53.1%), and to the shootout (47.8%). The results of logistic regression analyses showed a significant difference between regulation time and the shootout (OR 1.42, 95% CI 1.24 to 1.63; p = .000), as well as overtime and the shootout (OR 1.24, 95% CI 1.022 to 1.50; p = .029). Lastly, the difference between regulation time and overtime was not significant (OR 1.15, 95% CI .98 to 1.34; p > .05). Findings are discussed in terms of their implications concerning coaching strategies required to maximize or minimize the effects of the home advantage afforded to home teams.

"I don't think there's many kids who play sports who are also in gangs": Stakeholders' perspectives on the developmental role of sport in the lives of young

Holt, Nicholas L.; Scherer, Jay; Kock, Jordan R.; University of Alberta

The purpose of this study was to examine adult stakeholders' perceptions of the developmental role of sport in the lives of young people from inner city areas of a Western Canadian city. Semi-structured interviews were conducted with 10 adult stakeholders (e.g., social workers, addictions counselors, youth workers, and coaches) who were involved in the provision of sport and recreation based social services to young people from inner city areas. Interviews were transcribed verbatim and subjected to an inductive content analysis. Three main themes were identified. (1) Sport was generally viewed as an outlet that could help youth overcome the boredom in their lives. (2) Stakeholders thought the "inner world" of young people was restricted because few were aware of opportunities that existed belong a life of drink, drugs, and gangs. Sport was a way to expand the inner world of these young people, but adult stakeholders often encountered resistance and reluctance to change from the young people themselves. (3) Stakeholders suggested that the structural barriers to sport participation (and more generally a healthier lifestyle) could not be easily removed because they were so far reaching and institutionalized. Nonetheless, participants reported a range of possible solutions that would require creativity, collaboration, and coordination among multiple community agencies and levels of government. They also noted that although sport could play an important role in the young peoples' lives, this role needed to be placed in the wider context of the need for a broader range of support and social services. In summary, these findings suggest the potential developmental benefits of sport may be quite specific (i.e., a way of overcoming boredom and broadening individuals' inner worlds) and sport opportunities should be delivered as part of a broader framework of services. As one stakeholder concluded, "Sport is great and it's one thing, but it's only a part of the equation."

A multidisciplinary mixed methods approach to the evaluation of fatigue status in competitive swimmers

Holt, Nick L., University of Alberta; Kennedy, Michael, University of Alberta; Tamminen, Katherine A., University of British Columbia

Heavy training with inadequate recovery can produce accumulated fatigue and lead to overtraining and burnout. These issues are influenced by psychological and social factors associated with athletes' training environment. The first purpose of this study was to examine whether changes in physiological fatigue status and perceptions of training related

physical feeling occurred in relation to changes in training volume. The second purpose was to examine athletes' perceptions of psychological/social factors that influenced their fatigue. Participants were 25 varsity level competitive swimmers (14 males, 11 females; mean age = 20 ± 1, 20 ± years, respectively). Given the multifaceted nature of fatigue, a two phase mixed methods (quantitative-qualitative) approach was used. Phase 1 data were collected over the 23 week pre and competitive season using an orthostatic heart rate (HR) test and a self-report questionnaire to evaluate overall form, feeling, and fatigue status. Results indicate high levels of accumulated physiological and psychobiological fatigue that improved with increased recovery. Specifically, HR indices, form, feeling and energy level improved during taper periods and worsened during and immediately after intensive training blocks. During phase 2, five focus groups were conducted at the end of the season. Qualitative analysis produced four main themes that influenced athletes' fatigue: Balancing school, work, and sleep; teammate expectations; air quality, and flexible structure of training program. Within these themes data indicated that participants understood their level of fatigue was excessive but accepted this as a necessary part of swimming. In summary, findings revealed changes in training volume in relation to taper periods but participants were excessively fatigued throughout the competitive season. Given that athletes accepted excessive fatigue as part of their sport, the findings suggest that certain normative expectations and practices may contribute to accumulated fatigue and recovery.

Faster, higher, stronger, . . . , and younger? Birth order, sibling sport participation, and sport expertise

Hopwood, Melissa J., Victoria University; Baker, Joseph, York University; MacMahon, Clare, Victoria University; Farrow, Damian, Victoria University and Australian Institute of Sport

In the sporting domain, siblings can act as role models, practice partners, team mates, supporters, motivators, and even rivals. As such, they are an important consideration when investigating influences on sport expertise. The current study examined the characteristics and patterns of participation in sport and physical activity of siblings of 229 athletes from Australia and Canada, representing 36 sports and three skill levels (non-elite, pre-elite, and elite). Although there was no association between skill level and number of siblings, there was significant birth order effect, with elite athletes more likely to be later born children than both non-elite and pre-elite athletes ($\chi^2(4) = 15.10$, $p < .01$). Siblings of elite athletes were more likely to participate in various types of physical activity on a regular basis compared to siblings of non-elite athletes, with older siblings of elite athletes participating in general fitness activities ($\chi^2(2) = 6.20$, $p < .05$) and recreational sport ($\chi^2(2) = 6.63$, $p < .05$) more regularly than older siblings of non-elite athletes, and younger siblings of elite athletes participating in competitive sport more regularly than younger siblings of non-elite athletes ($\chi^2(2) = 11.77$, $p < .01$). When participating in competitive sport, siblings of elite athletes typically reached the pre-elite or elite levels of competition whereas siblings of non-elite athletes participated at the non-elite level only ($\chi^2(4) = 17.04$, $p < .01$). Interestingly, older siblings of elite athletes were less likely to have participated in the athlete's main sport compared to older siblings of non-elite athletes ($\chi^2(2) = 6.62$, $p < .05$). These results provide valuable insight into sibling dynamics as they relate to sport expertise, including both the influences that older siblings may exert on athletes as well as the influence the athlete may have on their younger siblings.

Sport expertise development: Skill level differences in practice profiles during childhood and adolescence

Hopwood, Melissa J., Victoria University; Baker, Joseph, York University; Farrow, Damian, Victoria University and Australian Institute of Sport; MacMahon, Clare, Victoria University

Practice is undoubtedly a significant contributor to sport expertise. Substantial evidence confirms expert athletes devote more time to practice than lesser skilled athletes; however, investigations typically involve a single practice factor, ignoring the multi-faceted nature of the practice environment. This study involved a detailed analysis of practice types associated with sport expertise development during childhood and adolescence. Practice histories were collected from 209 adult athletes from three skill levels (non-elite, pre-elite, and elite), and participation in 15 practice types were compared. Analysis was restricted to ages 5-17 to focus specifically on the childhood and adolescent years. Overall, elite athletes accumulated more hours of practice during this period than non-elite athletes ($F(2,206) = 3.26$, $p > .05$). From age 13, elite athletes participated in more hours per year of sport specific practice completed in a group with a coach than non-elite athletes, and at age 17 they participated in more hours of sport specific practice completed in a group but without a coach than both non-elite and pre-elite athletes. From age 15, elite athletes also participated in more hours per year of sport specific practice completed one-on-one with a coach compared to non-elite and pre-elite athletes; however, there were no skill level differences for participation in sport specific practice completed one-on-one without a coach. Additionally, elite athletes participated in more hours per year of physical preparation completed in a group with a coach than non-elite athletes from age 15. Participation in mental preparation or sport specific play did not differentiate elite athletes from lesser skilled athletes during childhood and adolescence; however, elite athletes participated in more training camps per year than sub-elite athletes from age 13, and pre-elite athletes from age 16. These findings provide insight into the practice activities that contribute most to sport expertise development during childhood and adolescence.

Questioning the importance of diversification for sport expertise development

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The association between sport expertise and participation in a variety of organized sports prior to specialization is widely accepted by sport researchers and practitioners. The current study examined this relationship in a sample of 193 athletes representing 2 countries, 36 sports, and 3 skill levels, with the results questioning the importance of diversification for sport expertise development. Details of participation in organized sports other than main sport were compared between non-elite, pre-elite, and elite level athletes aged 18-35, for the childhood and adolescent years. There were no skill level differences in the likelihood of athletes participating in other organized sports before age 18 ($\chi^2(2) = 3.44$, $p > .05$), and there were no skill level differences in the total number of organized sports played ($F(2,190) = 2.42$, $p > .05$); however, elite athletes participated in a greater number of other sports at the pre elite level of competition compared to non-elite athletes ($F(2,72) = 3.42$, $p < .05$). Despite participating at a higher level of competition in sports other than their main sport, elite athletes did not participate in more hours of other organized sports overall than lesser skilled athletes ($F(2,70) = 1.69$, $p > .05$). Among athletes who did participate in other organized sports during childhood and adolescence, elite athletes were more likely

to have specialized in their main sport before age 18 than non-elite athletes ($\chi^2(2) = 7.11$, $p < .05$), yet the age at which specializing athletes ceased involvement in other sports did not differ between skill groups ($F(2,8) = 1.12$, $p > .05$). These results suggest that participation in other organized sports may not be critical for sport expertise development, but it appears that elite athletes are relatively successful in other sporting endeavors outside of their main sport. Discrepancies between these results and previous investigations may be related to greater variability in sporting experiences among a larger, more diverse sample than is typically employed in studies of sport expertise development.

The effects of acute exercise on attentional bias toward smoking-related stimuli: A systematic review

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Introduction Attentional bias (AB) is a cognitive bias that substance users exhibit for addiction-related stimuli; specifically, these stimuli capture the attention of experienced substance users. This bias influences underlying processes of substance-seeking behavior, craving, and relapse. Exercise has been promoted as a technique for reducing cigarette cravings. However, little is known about the effects of exercise on AB. Methods A systematic review was conducted searching common databases with the following keywords: "attentional bias," "smoking," and "acute exercise" or "physical activity." Studies were included that (1) used a bout of exercise as the intervention and (2) assessed AB as an outcome measure. Due to differences in studies, no attempt was made at a meta-analysis and results are summarized narratively. Results Only four studies met the inclusion criteria. All were crossover designs, using abstaining smokers (mean age = 26.7 years), and AB was measured with eye-tracking technology. Of the four studies, two used cycling at different intensities (RPE range = 11-16.7), one used running (RPE = 16) and brisk walking (RPE = 11.8), and one reported brisk walking and seated isometric exercise. Exercise bouts were 10-15 min in duration. Craving was significantly reduced post-exercise in three of the four studies. There were small, significant reductions in AB, as measured by dwell time, initial fixation, and total fixation, in two of these three studies. Conclusion There is some evidence to suggest a modest effect of exercise in reducing AB in the context of nicotine addiction. Further research is needed to understand how different doses of exercise (e.g., duration and intensity) modify AB among different types of smokers (e.g., years of smoking). Novel attentional bias tasks should also be considered. This research was supported by a studentship from the Ontario Tobacco Research Unit (OTRU).

The relationship between physical fitness and EEG in attention deficit hyperactivity disorder children

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Children with attention deficit hyperactivity disorder (ADHD) consistently have higher theta/alpha, theta/beta ratios, and higher theta power than those without ADHD. Studies have found that higher theta power correlated with poorer performance in cognitive tasks for the ADHD. Furthermore, research indicated physical activity do benefits on cognitive function. The purpose of this study was to examine the relationships between ADHD

children's resting EEG and physical fitness. Thirty-two children (5 girls and 27 boys, 8.56 ± 1.29 years) diagnosed with ADHD were recruited. EEG were recorded from 9 electrode sites under both open-eyes and close-eyes condition. The EEGs were fast Fourier-transformed to provide power estimates for the theta, alpha, and beta bands. Ratio coefficients were also calculated for the theta/alpha and theta/beta ratios. Fitness included agility shuttle run, sit up, standing long jump, sit and reach, and composite score. Several multiple regression were employed. The findings showed, in close-eyes condition, fitness composite score was negatively related to F4(θ/α) and C4(θ/α). Sit up was negatively related to P4(θ/α), Pz(θ/α), and Cz(θ/α). Standing long jump was negatively related to C3(θ/β). Conversely, agility shuttle run was positively related to P3(θ/β) while sit and reach was positively related to F3 and F4 θ. As for open-eyes condition, fitness composite score was negatively related to F4(θ/α). Agility shuttle run was negatively related to F3, F4, Fz θ. In summary, most of these findings indicated that children with better fitness score had lower theta/alpha, theta/beta ratios and theta power. Since higher theta power and its related indices are a characteristic of ADHD and have been associated with poorer cognitive performance, lower theta power and its related indices in higher fit ADHD children suggest that the beneficial effect of physical fitness also applies to children with ADHD.

Athletes' perception of justice of the coach's leadership behaviors and athletes' commitment in sport

Huang, Ling-Wen; Liao, Chu-Min; Yang, Cheng-Hui; Ho, Wan-Jen; Liang, Feng-Wen; National Taiwan Sport University

Athletes' perception of justice of their coaches' behaviors may affect their cognitions, emotions as well as behaviors. We conducted two studies to examine the validity of the justice concept proposed in the organizational psychology literature in sport and the prediction of perception of justice to sport commitment. In the first study, 223 university athletes filled out a Chinese version justice scale. Factor analysis revealed 5 factors, which were distributive justice, procedural justice, voice, interactional justice, and respect. In the second study, another sample of 223 university athletes was recruited. Sequential regression analyses were employed to test the prediction of justice perception to "want to" as well as "have to" commitment separately. Both voice and procedural justice entered in step 1 and the others entered in step 2. In terms of the "want to" commitment, both voice and procedural justice contributed significantly to the prediction after step 1, $R2 = .09$, $F(2,220) = 11.25$, $p < .01$. Addition of distributive justice and interactional justice to the equation reliably improved R^2, $\Delta R^2 = .09$, F change $(3,217) = 8.25$, $p < .01$. In terms of the "have to" commitment, after step 1, only voice showed significant contribution, $R^2 = .09$, $F(2,220) = 10.96$, $p < .01$. After step 2, addition of distributive justice and respect to the equation reliably improved R^2, $\Delta R^2 = .08$, F change$(3,217) = 7.38$, $p < .01$. These results imply that a five-factor justice concept may describe athletes' perception of justice more comprehensively. In addition, athletes considering their coaches being fair in decision-making procedure, distribution of resources, and interpersonal treatment may be more willing to stay in the team. On the other hand, coaches who act fairly in opportunities for voice, distribution of resources, and showing respect may make athletes feel more constrained to stay in the team.

Self-determined motivation towards physical activity in patients with coronary heart disease

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Background: Patients with coronary heart disease (CHD) are recommended to engage in regular physical activity to improve health and lower the risk of recurrent cardiac events. Nonetheless, about 40% of patients with CHD in Taiwan do not engage in regular exercise. While a number of studies have examined the associations between motivation and physical activity in normal healthy populations, few study has investigated this relationship in individuals with chronic disease. Thus, the purpose of this study was to examine the associations between motivation and physical activity in patients with CHD. Methods: Patients with CHD were recruited for this study. Their motivation for exercise were measured by the Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2). Physical activity was assessed using the 7-day physical activity recall questionnaire. Duration and energy expenditure of total physical activity (TPA) and moderate to vigorous physical activity (MVPA) were used in data analysis. Results: The results of the 84 participants (mean age 57.44 ± 10 years) revealed that there was a significant positive correlation between intrinsic regulation and energy expenditure of MVPA ($r = .222$, $p = .049$). There was no significant correlation between other subscales of the BREQ-2 and duration or energy expenditure of MVPA. There was also no significant correlation between each subscale of the BREQ-2 and duration or energy expenditure of TPA. In addition, there was a significant positive correlation between calculated relative autonomy index (RAI) and duration of MVPA ($r = .233$, $p = .034$), and between RAI and energy expenditure of MVPA ($r = .294$, $p = .009$). Conclusion: The results of this study showed that intrinsic regulation and the degree of autonomy are significantly associated with level of physical activity at moderate to vigorous intensity in patients with CHD. It is suggested that a physical activity intervention program may target on enhancing one's intrinsic regulation to increase the likelihood of physical activity participation in this population.

The development of Finnish students' fundamental movement skills from Grade 7 to Grade 9

Huhtiniemi, Mikko M.; Jaakkola, Timo T.; University of Jyväskylä

Studies have shown that childhood and adolescence are crucial periods in the adoption of a physically active lifestyle. Research has also shown that mastery of fundamental movement skills (FMS) is a potentially significant factor in the rate of adolescents' physical activity participation. The purpose of this study was to analyze the development of the students' FMS from Grade 7 to Grade 9. The participants of the study were 152 (66 girls and 86 boys) Finnish students who were 13 years old and enrolled in Grade 7 at the beginning of the study. The participants completed the Finnish FMS test package annually during a three-year period. The package included seven tests analyzing students balance, locomotor, and manipulative skills. Before statistical analyses, the FMS sumscore was created by standardizing separate test scores and summing them together. Repeated measures MANOVAs were carried out in order to assess the development of students' FMS during junior high school. In the MANOVAs time (three measurement points) and gender were independent variables whereas FMS sumscore was dependent variable. The MANOVA for the students' FMS sumscore revealed a significant interaction between gender and time (Huynh-Feldt $F[1.91] = 24.74$, $p = .000$, $\chi^2 = .42$). Follow-up MANOVAs demonstrated that the girls and the boys differed between the first (Grade 7) and the second (Grade 8) measure $F[1.00] = 18.81$, $p = .000$, $\chi^2 = .11$), between the first (Grade 7) and the third (Grade 9) measure (Huynh-Feldt $F[1.00] = 40.39$, $p = .000$, $\chi^2 = .21$), and between the second (Grade 8) and the third measure (Grade 9) (Huynh-Feldt $F[1.00] = 8.30$, $p = .005$, $\chi^2 = .05$). The descriptive

statistics revealed that the boys' FMS sumscore increased whereas the girls' FMS sumscore decreased through junior high school. The decrease of the girls' FMS sumscore during the junior high school indicates that there is need to put special effort on developing girls FMS in junior high school.

Will Mu rhythm differentiate golf putting performance?

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Mu rhythm is a particular frequency band that usually encompassed in the alpha range (8-12 Hz) at the motor cortex. It is strongly suppressed during the performance of motor acts thus may be related to the quality of motor performance. However, research on the relationship between Mu rhythm and motor skill performance is almost nonexistent. As such, it is worthy to explore this particular class of EEG component due to its close connection to motor acts. Twenty college student golfers (aged 21.27 ± 1.59 years) with 8.5 ± 2.6 years of training and competition experience in golf were recruited. Each participant performed 40 putts with a distance to the hole of at least 3.5 m, depending on the individualized successful performance of 50%. EEG was recorded at Cz, C3, and C4. Cleaned EEG was fast Fourier transformed to derive the spectral power for Mu rhythm (8-12 Hz). A 2 (performance) × 3 (site) × 3 (time window) repeated measure ANOVA were used. Results showed that none of effects associated with performance were significant. Site main effect was significant. Follow up analysis showed that mu rhythm power was highest at Cz, followed by C3, lowest at C4. From this study, it appeared that Mu rhythm is not sensitive to golf putting performance. However, more study may be needed to confirm this conclusion.

The relationship between fundamental movement skills and physical activity during Finnish junior high school

Jaakkola, Timo; Huhtiniemi, Mikko M., University of Jyväskylä

Previous studies have shown that fundamental movement skills (FMS) and physical activity are related. Specifically, earlier studies have demonstrated that the ability to perform a variety of FMS increases the likelihood of children participating in a range of physical activities throughout their lives. The purpose of this study was to analyze the associations among the students' FMS and self-reported physical activity during junior high school (Grade 7 to 9). The participants of the study were 152 13 years old Finnish students enrolled in Grade 7 at the commencement of the study. The sample included 66 girls and 86 boys who were drawn from three junior high schools in Middle Finland. Both the Finnish FMS test package and questionnaires pertaining to self-reported physical activity were completed annually during a three-year period: In August (when the participants were in Grade 7), January (Grade 8), and in May (Grade 9). The relationships between self-reported physical activity and FMS were analyzed using the Structural Equation Modeling (SEM) with a multigroup method. The SEM indicated that FMS in Grades 7 and 8 as well as physical activity in Grade 9 explained FMS in Grade 9 in both gender groups. Squared multiple correlations revealed that these variables explained FMS in Grade 9, 69 % and 55 % in the girls and boys model respectively. Additionally, physical activity measured in Grade 7 and FMS measured in Grade 9 explained physical activity in Grade 9. Squared multiple

correlations revealed that that these variables explained FMS in Grade 9, 12% and 29% in the girls and boys model respectively. In the boys group, three additional paths were found; FMS in Grade 7 explained physical activity in Grade 9, physical activity in Grade 7 explained FMS in Grade 8, and physical activity in Grade 7 explained physical activity in Grade 8. These results suggest that in the boys' group rather than in the girls' group FMS and physical activity have reciprocal relationship during junior high school.

Getting on like a house on fire: The influence of temperature primes on interpersonal outcomes in physical activity-based interactions

Jackson, Ben; Dimmock, James A.; University of Western Australia

Although much is known regarding the dispositional factors that support social interactions, recent priming research has also begun to identify the environmental stimuli that subconsciously influence individuals' initial interactions with others (e.g., modifying one's physical temperature). Guided by existing work outside sport, we investigated the relative effect of warm and cold temperature primes on interpersonal outcomes in a one-to-one physical activity-based setting. Kinesiology undergraduates ($N = 51$, $M_{age} = 21.82$, $SD = 3.45$) were randomly assigned to be primed with words relating to warmth (e.g., warm, warming) or coldness (e.g., ice, frosty) via a computerized word-recognition program, and interpersonal measures were recorded during a subsequent netball shooting task, performed alongside a blinded confederate. We sought to test for differences between priming groups on the extent to which participants (a) mimicked the confederate's behavior, (b) engaged in helpful acts during the task, and (c) provided positive written trait descriptors about the confederate. A MANOVA revealed a significant multivariate effect for the temperature prime (F3, 47 = 9.03, $p < .001$, partial $\eta^2 = .37$), and follow-up analyses showed that participants primed with the concept of warmth engaged in greater behavioral mimicry (F1, 49 = 21.78, $p < .001$, partial $\eta^2 = .31$) and more helpful acts (F1, 49 = 7.86, $p = .007$, partial $\eta^2 = .14$) than those primed with the concept of coldness. Importantly, these effects emerged despite there being no baseline differences between experimental groups on a number of theoretically relevant background variables (i.e., agreeableness, extraversion, attachment style), and a manipulation check revealed that participants were unaware of the influence of the prime. Mimicry and helpfulness are functionally significant in promoting liking and rapport in social interactions, and these findings indicate that the activation of temperature-related concepts can subconsciously influence individuals' interpersonal behavior in physical activity contexts.

Peer- and instructor-focused relation-inferred self-efficacy beliefs in physical activity classes: Predicting cognitive, attitudinal, and affective outcomes

Jackson, Ben; Dimmock, James A.; Whipp, Peter R.; University of Western Australia

In physical activity classes, alongside their confidence in their own ability (i.e., self-efficacy), students also develop estimations about how confident they believe others (e.g., instructor, peers) are in their ability. This metaperception, termed relation-inferred self-efficacy (RISE), is theorized to be associated with one's self-efficacy, as well as a range of motivational and behavioral outcomes. Researchers have begun to identify the outcomes associated with students' estimations of their instructor's confidence in them (i.e., instructor-focused RISE), but are yet to simultaneously explore students' estimations about their classmates' confidence in their ability (i.e., peer-focused RISE). We recruited 340 undergraduates ($M_{age} = 18.54$, $SD = .56$) from compulsory, semester-long swimming or tennis classes. At time one, we

measured instructor- and peer-focused RISE beliefs, and the following week we assessed students' perceptions of peer acceptance in the class, as well as their task self-efficacy and self-presentational efficacy beliefs. Another week later, students reported their attitudes toward the activity they were undertaking, as well as their enjoyment and social physique anxiety. Latent variable path analyses revealed that although instructor-focused RISE beliefs only predicted students' task self-efficacy ($\beta = .32$, $p < .001$), those who estimated that their classmates were highly confident in their ability reported strong perceptions of task self-efficacy ($\beta = .51$, $p < .001$), self-presentational efficacy ($\beta = .44$, $p < .001$), and peer acceptance ($\beta = .36$, $p < .001$) in their class. In line with theory and research, students' perceptions of self-efficacy and peer acceptance displayed a number of predictive effects in relation to attitudes, enjoyment, and social physique anxiety. These findings underscore the importance of examining the distinct types of RISE appraisals that individuals may develop, and demonstrate that this metaperception may be important in predicting cognitive, affective, and attitudinal outcomes in physical activity classes.

Mental rotation performance in soccer players

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Rotational movement experts perform better on mental rotation tasks with perspective but not with object-related transformations (Steggemann, Engbert, & Weigelt, 2011). Here it was investigated whether experts in translational and rotational movements (soccer players) also perform better on an object-related mental rotation task with either neutral stimuli (cube figures) or embodied stimuli (head-cube figures and human postures) (Amorim, Isableu, & Jarraya, 2006). Adult males (20 soccer players and 20 non-athletes) solved a chronometric mental rotation task. Two objects within one stimuli category were presented pairwise. Participants had to decide if the objects were the same or different. Error rates and reaction times were analyzed as dependent variables. The factor "group" (soccer players vs. non-athletes) served as the between subject factor. The factors "angular disparity" (0°, 30°, 60°, 90°, 120°, 150°, or 180°) and "stimulus type" (cubes vs. head-cube figures vs. human postures) were the within subject factors. Concerning reaction time and error rate, two analyses of variance with repeated measurements showed main effects for angular disparity, $F(6,228) = 112.34$, $p < .001$ and $F(6,228) = 43.47$, $p < .001$, and stimuli type, $F(2,76) = 69.58$, $p < .001$ and $F(2,76) = 55.71$, $p < .001$; and significant interactions between both factors, $F(12,456) = 21.19$, $p < .001$ and $F(12,456) = 30.69$, $p < .001$. All participants showed a higher error rate and reaction time for cube figures in comparison to the embodied stimulis, but only at higher angular disparities. Most interestingly, reaction time showed a significant interaction between stimuli type and group, $F(2,76) = 3,72$; $p < .05$. Only the soccer players showed a faster reaction time for embodied stimuli than for cube figures. In contrast to the study of Steggemann et al. (2011), this result showed an effect of motor expertise in reaction time even with object-based transformations. However, this effect is selective to the embodiment of the stimuli and shows the importance of sports for embodied cognition.

The cases of counseling and psychological skills training to a fin swimming elite athlete

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This study conducted counseling and psychological skills training to a fin swimming elite athlete in order to suggest procedures and contents for the programs and verify their

effects on psychological skills and game performances through that. To attain the goal of this research, this study focused on designing and implementing the psychological skills training as considering the psychological characteristics and individual needs of the participant. Based on that, this research is conducted with the method of case study through single subject design. The psychological skills training was performed total 21 sessions with direct interviewing and task assignment. The goal was set to provide the psychological skills training which helps to figure out the athlete's psychological strengths and weaknesses, solve the client's psychological problems such as anxiety, negative thoughts, and self-disbelief, and to improve performances. The methods such as thought stopping, cognitive restructuring, strain relief, goal setting, competition reflection, and imagery training were applied in a phased manner, and ultimately, routine for the world competition was developed for mastery. According to the response from the athlete in the interview, the part regarded as a psychological problem was improved generally after the treatment of the training. It is thought that this was mostly settled with the provision of solutions in in-depth interviewing and the psychological skills training program. Also, it is thought that the programs contributed to the performance improvement as well, considering the athlete's winning the silver medal in the world competition.

The relation between exercise participation, motivation and psychological needs satisfaction among rural-dwelling older adults

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One way to improve health and prevent the negative effects of aging is through exercise. There are many factors that influence exercise participation, but little is known about the impact of the variables described by the Self Determination Theory on motivation to exercise among rural adults. Therefore, the purpose of this study was to compare the differences in intrinsic motivation (IM) and extrinsic motivation (EM) among structured exercisers (SE), unstructured exercisers (UE), and inactive (IA) rural-dwelling older adults. A secondary purpose was to examine psychological needs satisfaction (PNS) components (autonomy, competency, relatedness) related to exercise among SE and UE participants. Participants included 160 rural-dwelling older adults (≥65 years) split into three groups: SE (n = 62), UE (n = 49), and IA (n = 49). The Exercise Motivation Inventory-2 (measure of IM/EM using 5 subscales: functional improvements, health-related motivators, intrinsic motivation, social affiliation, appearance) and Psychological Needs in Exercise Scale (measure of autonomy, competency, relatedness) were administered. One-way independent ANOVA analyses showed significant motivation differences between the SE, UE, and IA groups for the functional improvements ($p < .01$) and health-related factors ($p < .05$) subscales. Independent t tests revealed SE had significantly lower levels of autonomy [$t(109) = -3.17$ ($p < .01$)] and significantly higher levels of competency [$t(109) = 2.47$ ($p < .05$)] and relatedness [$t(109) = 8.18$ ($p < .01$)] compared to UE. These results indicate that older rural-dwelling exercisers are driven by EM in order to participate in activities of daily living and combat the effects of aging, versus for IM or appearance reasons. SE also demonstrated higher PNS in the form of relatedness and competency compared to UE, thereby increasing the likelihood for exercise persistence. Exercise interventions in this population should emphasize the functional, health, and social benefits of exercise in order to increase motivation and therefore, participation and adherence.

Social influences and psychological and physical well-being among female adolescent gymnasts

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Female adolescent gymnasts undergo rigorous training, evaluative judging, and pressure to maintain a lean body, putting them at risk for declining well- being, such as low self-perceptions, negative affect, and disordered eating (Horn, 2004; Krane et al., 1997). According to self-determination theory (SDT), the social context impacts psychological need satisfaction (perceived competence, autonomy, relatedness) and in turn well-being (Ryan & Deci, 2000, 2007). Using SDT, this study assessed relationships among coach and teammate behaviors, need satisfaction, and well-being indices. Female competitive gymnasts ($N = 303$) ages 10 to 17 ($M = 13.0$, $SD = 1.9$) completed a survey to assess study variables. A measure of physical maturity was also included. A model of relationships was specified and tested using structural equation modeling. The model showed a reasonable to good fit to the observed data, χ^2 (267) = 422.12, $p < .05$ (χ^2 /*df* = 1.58); RMSEA = .04; NNFI = .96; CFI = .97; GFI = .90. Coach autonomy-support, mastery climate, and friendship quality showed strong, positive relationships with one or more of the psychological needs. Perceived competence was positively and strongly related to self-esteem and positive affect and negatively related to disordered eating. Significant, indirect relationships also emerged. Coach autonomy-support and mastery climate were related to positive affect through coach relatedness, and friendship quality was associated with all three well-being indices through perceived competence and teammate relatedness. Physical maturity showed indirect relationships with all three well-being indices through perceptions of competence. Findings provide support for SDT and suggest the social, psychological, and developmental processes that are related to higher and lower well-being among female adolescent gymnasts. Coaches can help optimize physical and psychological well-being by emphasizing self-referenced criteria for success, providing opportunities for demonstrating autonomy, and structuring activities to promote positive teammate interactions.

Pattern of golfers' imagery ability and imagery use: The imagery training program model intervention

Kokkonen, Juha Antero, Jyväskylä University; Watt, Anthony, Victoria University

Mental imagery constitutes "a symbolic sensory experience that may occur in any sensory mode" (Hardy & Jones, 1992, p. 67) and is accepted as an important psychological skills training technique in sport. Imagery ability represents the capacities of the individual to create images, and is evaluated in terms of generational, sensorial, and emotional elements, whereas imagery use is a manner in which individual employ imagery to learn and develop skills, and to facilitate performance of those skills (Morris, Spittle, & Watt, 2005). However, knowledge about the effective delivery of the imagery training in terms of imagery ability and imagery use is limited. Based on the Imagery Training Program (ITP) model we examined how golfers' perceived their participation in a 1-month imagery intervention that focused on their imagery skills and use of imagery for performance development. Participants ($N = 11$, 8 males and 3 females) were three Finnish and eight South African elite level golfers of whom five were professional and six national level amateurs. Under the guidance of researchers, participants developed the content of the specific imagery scripts for their ITP goal and used the scripts 20 times over a one month period. Their perceptions of the content of imagery scripts in terms of imagery ability and imagery use were examined through individual one-hour interviews involving 17 questions developed on the basis of specific

previous research (i.e., MacIntyre & Moran, 2007; Watt, Morris, & Kohen, 2010). Data was examined using content analysis. According to golfers, the scripts within the ITP were useful for their performance enhancement and convenient to incorporate into another training schedule. The ITP was used both to develop specific playing skills and attentional characteristics of performance. Golfers preferred specific elements associated with their ITP goals rather than a focus on their entire playing environment. Professional players found imagery content easier to generate and they favored kinesthetic senses over other sense modalities.

Petrolheads or chilled as ice?: The emotional attributes of Finnish motorsport athletes

Kokkonen, Marja

The present study focused on the self-reported emotional attributes in licensed Finnish motorsport athletes. The aims of the study were to investigate, whether 1) licensed Finnish motor sport athletes ($N = 378$ drivers in total) competing at the national vs. international level differed from each other in terms of their emotional attributes, 2) their emotional attributes were related to their competition level, and 3) subgroups of drivers could be identified based on the similarities in emotional skills related to emotional intelligence. Self-report data were collected anonymously through an online survey placed on the Finnish Automobile Sport Federation webpage, open to its licensed drivers. *T* tests revealed a tendency of drivers competing at the international level to score higher in seeking emotional experiences and situations, thrill and adventure, competitiveness and efficiency. Correlational findings showed for the whole sample, that competitiveness was related to drivers' higher competition level ($r = .23$, $p = .000$). In a subsample of rally drivers ($n = 168$) only, psychological distress, psychosomatic symptoms, and a tendency to avoid emotional situations were related to lower competition level. In Ward's hierarchical cluster analysis, confirmed by the non-hierarchical *k*-means cluster analysis, four distinct groups of drivers based on their emotional skills emerged. The group of 77 Emotionally Skilled Drivers scored highest in competitiveness and lowest in impulsivity, in avoidance of emotional situations, and in alexithymia. Compared to the most extreme group of 46 Emotionally Least Skilled Drivers, they also scored higher in anger control, and lower in suppression of anger, disinhibition, and ADHD. However, no differences in terms of competition level, years of driving, or type of motor sport were found between the clusters. The results suggest that if coaching addresses emotional issues, and enhancing drivers' emotional skills, some motorsport athletes might find it beneficial to their sporting careers.

Effects of sex, body size and physical task on personal attribute ratings

Kolks, Jonathan; Fleischmann, Keith; Wright, Tim; McCombs, Kristin; Raudenbush, Bryan; Wheeling Jesuit University

Body image remains a serious topic of modern society with numerous outlets of media placing emphasis on body size, body composition, and weight status. Mass media continually enhances our opinion of what is "ideal" in regards to body weight. The present study asked 96 participants to rate pictures based on attractiveness, intelligence, healthiness, successfulness, trustworthiness, sexiness, promiscuity, willingness to kiss, willing to date, and willingness to have intercourse with. The pictures varied in sex (male and female), body size (small, medium or large), and activity being engaged in (control, treadmill, watching television, eating from a bowl, and drinking a beer). As body size increased, ratings decreased. Both male and female participants rated small body types the highest and large body types the lowest for all activities, with medium body types in the middle. Males rated the treadmill

task pictures as healthiest, while females rated the treadmill task pictures as most successful, healthy and intelligent. In terms of sex of the pictures and task, the female treadmill picture was rated the highest while the male beer picture was rated the lowest. Overall, researchers found four main areas that were consistent throughout the entire experiment; these included females were more critical of ratings than males, females were rated higher by both sexes, as body size increased attribute ratings decreased, and physical activity improves perceived personal ratings, while watching television, drinking a beer, or eating diminishes such ratings. These results are particularly salient in relation to how a person is judged based on the physical task in which they are engaged.

Effects of video game console type and snack type on snack consumption during game play: Nintendo Wii vs. Microsoft X-Box

Kolks, Jonathan; Wright, Tim; Raudenbush, Bryan, Wheeling Jesuit University

Past research has shown the effects of distraction on general food intake, with greater distractions leading to decreased food consumption. The present study examined the specific effects of snack type (healthy, unhealthy, and neutral) on snack consumption while playing video games. During play, participants wore an Actiwatch monitor, which measured their movement and caloric expenditure. For one of the conditions, the participants played the Nintendo Wii's boxing game that comes equipped on Wii Sports. The participants warmed-up for 5 min and continued to play the game for the duration of the 15-min session. For another condition, the participants played the X-Box version of Rocky Legends on exhibition mode. The participant warmed-up for 5 min and then continued to play for the duration of the fifteen-minute session. The third condition was used as a control, and the participants sat in an empty room for the duration of 15 min. All participants completed all three conditions. Before and after each condition, the participant's physiological measurements were taken. Three different snack types (healthy, unhealthy, and neutral) were available in the room during each condition, which consisted of 38 g of pretzels, 160 g of carrots, and 100 g of M&M's. Overall activity level (movement) and caloric expenditure was greatest in the Wii condition indicating significantly more calories burned. In addition, participants ate less overall in the Wii condition. Although both the Wii and X-Box conditions showed less snack consumption in general, participants ate more healthy snacks in the Wii condition. Thus, the Wii gaming condition led to more activity, greater caloric burn, less consumption of snacks, and, when a snack was consumed, the choice of a more healthy snack. These data suggest that the interactive style of the Wii gaming system can promote healthier snack choices due to active engagement, lead to greater caloric burn, and subsequent weight loss.

Comparison with different types of exercises on the Tower of London Test

Kong, Hsiao-Fang; Chang, Yung-Cheng; Lee, Pei-Ching; Shih, Jun-Yi; Chang, Yu-Kai, National Taiwan Sport University

Several studies have found that fitness is positively associated with cognitive functions. Furthermore, evidence has suggested that people with higher fitness have superior performance on executive functions, and a high-level or meta-cognition, including planning, ordering, inhibition, and working memory. However, the majority of studies focus mainly on aerobic exercise and inhibition, while the effects of exercise modalities on the planning aspect of executive functions is largely unknown. The purpose of this study is to examine the effects of different exercise modalities, specifically, those of jogging and martial arts

groups, on planning. Thirty participants were recruited: Two groups of participants have been through years of professional training (10 jogging athletes and 10 martial arts athletes. The rest of the participants were college students who do not regularly exercise. All participants completed the cardio-respiratory test and the Tower of London Test [TOL]). A one-way ANOVA observed that no significant differences in the all indices of TOL (correct score, move score, rule violation score, time violation score, and time related indices) have been found between the three groups. However, our study found that the performance of correct score in both exercise groups were marginal superior to that of the control groups. The findings reflect that these exercise modalities might have limited effects on executive functions. Future research is suggested to examine the effects of various modalities, such as other types of close- skilled or open-skilled exercises, on executive functions.

Parents pressuring their kids to be active: Parent self-efficacy, other-efficacy, and negative social control

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Social control is a regulatory form of social influence that an individual uses when another person deviates from a health-related norm (Lewis & Butterfield, 2005). While parent physical activity (Wilson & Spink, 2010; Wilson, Spink & Priebe, 2010) and perceived importance (Wilson, Spink & Priebe, 2010) have been identified as antecedents of positive and collaborative social control in the activity setting, less is known about antecedents of negative social control— a pressuring form (i.e., nagging). One possible antecedent of negative social control is based on the suggestion by Lent and Lopez (2002) that interactions may be influenced by ones' interpretations of the capabilities of oneself (self-efficacy) and of the other person (other-efficacy). As such, one wonders if parents' perceptions of their own capabilities to manage their child's behavior (self-efficacy) and perceptions of their child's capabilities to be physically active on their own (other-efficacy) would influence parents' use of negative social control. The purpose of this study was to evaluate whether self-efficacy (parent) and other-efficacy (child) would predict use of negative social control. Parents ($N = 24$) in a pilot study completed two online surveys one week apart where they were asked a series of questions regarding self-efficacy (confidence in self), other-efficacy (confidence in child) and parents' use of social control (Wilson, Spink, & Priebe, 2010). After controlling for social control use at time one, hierarchical regression results revealed that the addition of self-efficacy and other-efficacy improved the model, $F(2,20) = 3.09$, $p = .07$, explaining an additional 12.4 % of variance in negative social control one week later. Other-efficacy (confidence in the child) was inversely related to the use of negative social control ($b = -0.27$, $p = .03$) Parent self-efficacy was not a significant predictor ($p = .12$). These preliminary results indicate that a parent's decision to use negative social control may be affected by the perception of their child's capabilities to be physically active.

The estimation of knee joint moment in motion by combining a neural network, EMG and a dynamometric measurement

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The estimation of knee moment in motion is important in understanding the occurrence of injuries in sporting activities as well as for rehabilitation after the injury. The estimation of knee moment in motion could be accomplished by the method of the inverse dynamics,

which requires joint kinematics and the floor reaction force. The estimation of physical properties of limb segments for a specific individual is difficult and the precise placement of foot in relation to the force plate for measurement may be an additional constraint to natural movement. The other method of the estimation is based on the activity levels of muscles captured by EMG. It requires less constraint to motion, but the relationship between joint moment and the activity levels of muscles is not simple. In many cases, the reference values would be obtained from a maximal voluntary effort with isometric contraction. In this study, the EMG of leg muscles and knee moment were measured by dynamometer at various speeds of movements with different moment values in concentric and eccentric mode of contractions. A two-layer feedforward neural network captured the relationship between joint moment and EMG, knee angle and angular velocity. The same subject performed motor task such as squatting on the force plate with reflective markers on the bony landmarks. One knee joint moment was calculated using the inverse dynamics using kinematic measurement of joints and force plate data. The neural network using EMG and joint kinematics estimated the other version of knee joint moment. The trained neural network could capture the relationship among dynamometric variables successfully. In tasks on the floor, two versions of estimated knee moments showed significant agreement. However, the degree of agreement seemed to be negatively affected where the data used for training the neural network was scarce. The result of the study indicates the potential use of neural network in capturing the nonlinear relationship between joint moments, muscle activities and joint kinematics in motion.

Comparing the self-efficacy/performance relationship in continuous and trial-to-trial sport tasks

LaForge-MacKenzie, Kaitlyn; Sullivan, Philip J.; Rickers, Kate R.; Brock University

Previous research has examined the relationship between self-efficacy and sport performance almost exclusively in trial-to-trial settings (e.g., Feltz, 1982; Wakins, Garcia, & Turek, 1994). Recent research has further examined the self-efficacy/performance relationship in continuous or interrupted sport tasks, revealing a similar reciprocal relationship to that of the trial-to-trial models (LaForge & Sullivan, 2010). The purpose of the present study was to compare the strength of the self-efficacy/performance relationship between continuous and trial-to-trial procedures. Participants were divided into continuous (n = 63) and trial-to-trial (n = 41) conditions. Both conditions involved dribbling a basketball around a series of pylons six times while using an original self-efficacy measure before each of the six segments. Performance was timed in seconds for each segment. In the continuous condition, participants used the self-efficacy measure at the beginning of each segment (i.e., while changing direction), without stopping the trial. In the trial-to-trial conditions, participants stopped after each segment for a total of 5 seconds, and used the self-efficacy measure before beginning the next segment. Using unresidualized data, the trial-to-trial model showed an excellent fit to the data (Bentler-Bonnett Non-Normed Fit Index = .96; CFI = .97; Standardized RMR = .09; RMSEA = .11) whereas the fit for the continuous data was not as strong (Bentler-Bonnett Non-Normed Fit Index = .90; CFI = .93; Standardized RMR = .10; RMSEA = .17). Specific differences in significant causal pathways were examined by an analysis of invariance between the two conditions. Both conditions support the strong link between performance and efficacy, although this relationship may be stronger in continuous than in non-continuous tasks.

Examining psychobiological responses to body image threats in women: An application of social self-preservation theory

Lamarche, Larkin; Kerr, Gretchen; University of Toronto; Gammage, Kimberley L., Brock University; Faulkner, Guy, University of Toronto; Klentrou, Panagiota, Brock University

Social self-preservation theory (SSPT) states that social-evaluative threats elicit a set of psychobiological responses. The present study examined the psychobiological response to, and recovery from, a social-evaluative body-related threat. College women ($N = 66$) were randomized into either a control (quiet rest) or threat group (completed a body composition assessment while wearing a two-piece bathing suit). Participants completed measures of state body shame, social physique anxiety, body dissatisfaction, and provided a sample of saliva (to assess cortisol levels as an indicator of physiological stress) at baseline, immediately following their condition, and 40 min following termination of their condition. The results indicated a significant group by time interaction for cortisol ($F(2, 63) = 5.29$, $p < .01$) and social physique anxiety ($F(2, 63) = 4.24$, $p = .02$). Follow-up analyses indicated that cortisol was significantly higher immediately following the threat ($M = .10$, $SD = .07$) in comparison to baseline levels ($M = .09$, $SD = .05$). Cortisol levels significantly decreased for those in the control group (baseline $M = .13$, $SD = .12$; response $M = .11$, $SD = .09$; recovery $M = .11$, $SD = .08$). Follow-up analyses showed that social physique anxiety was significantly higher immediately following the threat ($M = 2.88$, $SD = .87$) in comparison to baseline levels ($M = 2.60$, $SD = .81$) and recovery levels ($M = 2.65$, $SD = .86$). Levels of social physique anxiety did not change in the control group (baseline $M = 2.60$, $SD = .86$; response $M = 2.56$, $SD = 1.01$; recovery $M = 2.63$, $SD = 1.05$). No changes in body shame or body dissatisfaction were found in either group. Findings provide support for SSPT's applicability to a body image context.

The Chinese version of the Passion Scale for Sport and Exercise: Revising and structure reexamination

Lee, Chi-Chung; Liao, Chu-Min; Huang, Ling-Wen; Shen, Wei-Jiun; Wu, Hsiu-Tin; Liou, Chee, National Taiwan Sport University

The purpose of present study was to revise a Chinese version of Passion Scale for Sport and Exercise based on the Dualistic Model of Passion (Vallerand et al., 2003). Vallerand and his colleagues developed a 14-item Passion Scale in 2003 to measure individual's passion toward an activity. Since then, a number of studies have been acknowledging using this 14-item scale. However, most of these studies actually used a 12-item scale other than the original 14-item scale. These studies still cited the original paper of Vallerand et al. (2003) but not the actual source of the 12-item scale of Vallerand's laboratory website. We conducted two studies to examine the structural validity of the 14- and 12-item by means of CFA. In study 1 ($N = 392$, college students), the original 14-item Passion Scale (Vallerand et al., 2003) showed an inadequate fitness ($\chi^2 = 513.56$, $df = 76$, $p < .05$, RMSEA = .13, SRMR = .82, CFI = .92, NNFI = .91, PNFI = .76). In study 2 ($N = 518$, college students), we found that the 12-item Passion Scale had an acceptable fitness ($\chi^2 = 272.52$, $df = 53$, $p < .05$, RMSEA = .086, SRMR = .05, CFI = .95, NNFI = .94, PNFI = .75). In sum, our studies show that the 12-item Chinese version of Passion Scale for Sport and Exercise has a better factor structure than the 14-item version. This may due to the four passion-criteria items in the 12-item version serving to rule out the non-passionate.

Effects of different types of exercise on cognition assessed by the Stroop Test

Lee, Pei-Ching; Chu, Chien-Heng; Chan, Kuei-Hui; National Taiwan Sport University; Chi, Lin; Ta Hwa Institute of Technology; Chang, Yu-Kai; National Taiwan Sport University

The relationship between physical fitness and cognitive functions has drawn increasing attention recently. Previous studies have found that compared to less fit people, people with higher levels of physical fitness have superior performance on cognitive functions. Studies have further indicated that exercise modalities and complexity might have differential effects on brain structure and plasticity, as well as on cognitive functions. Nevertheless, little research has been focused on the issue of exercise modalities, fitness, and cognitive functions. The purpose of this study was to assess the effects of different exercise modalities on fitness and cognitive performances. Thirty healthy colleague students were recruited; 10 participants were professional distance runners (Running group, mean age = 19.7 years), 10 participants were masters in the martial arts (Martial arts group, mean age = 19.4 years), and the other 10 participants were people without habitual exercise habits (Control group, mean age = 19.3 years). Cardiovascular fitness of the participants was measured. Cognitive function was assessed by the Stroop Test (Stroop-Congruent, Stroop Color, and Stroop Incongruent conditions), which has been widely employed to measure simple information processing, and the inhibition and interference aspects of cognitive functions. The results revealed that the fitness of the Running group was superior to that of the Martial arts group and that of the Control group. Nevertheless, no significant differences in performance on the three Stroop Test conditions were found among the groups. These results imply that various modalities of close-skilled exercise might have limited effects on information processing, and the inhibition and interference aspects of cognitive functions. It may therefore be worthwhile to investigate the effects of different modalities including open-skilled exercises on cognitive functions.

Emotion education in sport: Moving from misconceptions, suppression, and health problems toward awareness, acceptance, and improved overall performance and well-being

Lee Sinden, Jane M.

Health problems in sport, such as eating disorders, chronic injuries, and/or substance abuse, have been a concern for coaches, parents, researchers and other sport advocates for decades. Recent research continues to try to understand the development of health problems, but has also turned to trying to understand athletes' conscious disregard of their health problems for the sake of continued training and sport performance (Lee Sinden, 2010). In order to try to understand athletes' actions, researchers have explored the role of emotional norms in sport, as they often lead to emotional control, suppression, and subsequent unhealthy behaviors by athletes. For instance, research has shown that many athletes believe the misconception that by ignoring their injuries they are displaying mental toughness (Jones, Hanton, & Connaughton, 2002; Lee Sinden, 2007; 2010; Mankad, Gordon, & Wallman, 2009). Unfortunately, with this belief, many athletes have suppress their feelings and concerns about their injuries or other health problems, only to eventually exacerbate their health problems and decrease their sport performance (Lee Sinden, 2010). In light of recent research the following paper/presentation explores the need for changing the language of emotion in sport, by breaking down old historical misconceptions about emotion and fostering more mindful awareness and commitment (Gardner & Moore, (2007; 2004). In

particular, this paper explores the importance of teaching athletes what emotions are, how to be more aware of their emotions, how to accept their emotions, and how to commit to their emotional experiences in a way that can improve their health and long-term sport participation and performance. Further, this paper gives suggestions on what "emotion education" would look like and how it might be implemented within Canada's National Long Term Athlete Development Plan.

Ontario ice-hockey participation for children between the ages of 10 and 15: An examination of the relationship between relative age and dropout rates

Lemez, Srdjan; Weir, Patricia; University of Windsor

Sport is one avenue through which positive youth development can occur (Jones et al., 2011). While a great deal about sport participation is positive, there are some structural issues in sport that may detract from positive development. For example, registration cut-off dates, initially intended to equalize competition, facilitate instruction, and provide for program continuity (Barrow & McGee, 1971), may have negative consequences on development through sport. This occurs because of the influence of the relative age effect (RAE). RAEs refer both to the immediate participation and long-term attainment constraints in sport, occurring as a result of chronological age, physical differences, and selection practices in annual age-grouped cohorts (Cobley et al., 2009). Canadian youth ice-hockey is a system with a high number of dropouts as a result of the high percentage of players registered on a team. Dropout may be precipitated by several factors, including: physical growth, biological maturity, and sport-specific skills (Figueiredo et al., 2009). Despite this knowledge, researchers have not systematically examined the issue of hockey dropout as a function of relative age. The purpose of the study was to investigate to what extent RAEs play a role in dropout of Ontario Minor Hockey Association youth hockey players. Specifically, the study tracks a male cohort of players (n = 14,325) born in 1995, over a five-year period from ages 10 to 15 years. Based on an annual participation cut-off date of December 31st (Hockey Canada, 2011), birthdates were coded and placed into quartiles. It was hypothesized that relatively younger participants would be more likely to dropout or transfer from elite levels of competition. Participation trends indicated that dropout was highest in the relatively youngest players, and that players born in the first half of the year retained a higher level of participation over the five years [$\chi^2(3) = 12.85$, $p < .05$; w = .030]. Results will be discussed with reference to current RAE literature. Funded by SSHRC.

The relationship between eating disorders and motivation in cardio-based fitness classes

Lentillon-Kaestner, Vanessa; University of Teacher Education; Allain, Mélanie; University of Lausanne

Fitness classes are considered high-risk sports in the development of eating disorders besides aesthetic sports, weight division sports, endurance sports and low weight performance sports; nevertheless, studies on eating disorders (ED) in fitness activities are rare. The purpose of this study is to investigate the relationship between ED and motivation among females in cardio-based fitness classes. In all, 1270 females (M = 23.68 years-old, SD = 3.04) completed a questionnaire incorporating among others the Eating Attitude Test (EAT-26), the Body Shape Questionnaire (BSQ-8C), questions about weight-loss methods and an open-ended question allowing to evaluate the main motivation to practice fitness

sports. In addition, 40 females practicing fitness sports and suffering of ED (15) or not suffering of ED (25) were interviewed. Quantitative data indicated that motivations for fitness sport were principally related to health (64.16% of females), followed by appearance and weight management (13.77%); enjoyment was rarely cited (7.36%). In our sample, 10.31% of females reached the critical threshold reflecting ED (EAT score > 20). The "exercise for weight/appearance" motivation was associated with eating disorder indicators such as a higher EAT-26 score, a higher body dissatisfaction, a higher frequency and a longer use of weight-loss methods. Qualitative data showed similar results: females interviewed with ED practiced sport with the single motivation of weight/appearance management. More precisely, three sub-logics emerged: a "lose weight logic," a "body control logic," and a "compensatory logic." On the other hand, among interviewed females without ED, the weight/appearance management was important but accompanied by other important motivations: social, psychological, physical health reasons and sometimes also enjoyment. Showing important differences in sport motivation between females with and without ED, our results underline the importance to understand motivation for sport participation to improve ED prevention strategies.

The role of exercise identity and self-presentational efficacy: Together in an exercise context

Liardi, Vincent L., Western University; Gammage, Kimberley L., Brock University; Hall, Craig R., Western University

Self-presentational efficacy (SPE) refers to one's expectancies that she or he can create desired impressions on others. Exercise identity (EI) refers to one's internalized belief that exercising is a core component in his/her individuality. These embedded psychological variables have yet to be examined, together, for their impact on social physique anxiety (SPA) and overall exercise participation. This study examined the correlations between these variables, potential gender differences, and the unique contribution of SPE and EI in anxiety and exercise behavior (total weekly minutes) variance. Ninety-nine females and fifty-four males ($N = 153$) with a mean age of 26.99 completed measures of exercise identity, self-presentational efficacy, and social physique anxiety. As expected, analyses revealed a positive correlation between EI and SPE ($r = 0.56$, $p < 0.01$) and a negative correlation between SPE and SPA ($r = -0.27$, $p < 0.01$). A gender difference existed for the SPE and SPA relationship, as males had a stronger and significant correlation ($r = - 0.43$, $p < 0.01$) than did females ($r = -0.15$, $p > 0.05$). The results of the multiple regression, which included all 153 participants, revealed that SPE explained 6.3% of the unique variance in SPA ($R^2 = 0.63$, $F(1,114) = 7.66$, $p = < 0.01$). Thus, SPE significantly predicted SPA ($\beta = -0.30$, $p < 0.01$) while EI did not ($\beta = 0.10$, $p > 0.05$). An additional regression determined that EI explained 21.6% of the unique variance in exercise behavior ($R^2 = 0.62$) $F(1,113) = 37.38$, $p = < 0.01$). While EI was predictive of exercise habits ($\beta = 8.96$, $p < 0.01$), SPE ($\beta = 0.04$, $p > 0.05$) and SPA ($\beta = 0.02$, $p > 0.05$) were not.

Engagement patterns in 55-90 year old adults: The impact on cognitive and physical function

Liffiton, Jacqueline A.; Weir, Patricia; University of Windsor

Little is known about the types of activities that seniors engage in. In the current study engagement has been categorized as including productive activities, social activities, passive

and active leisure activities. While the successful aging literature suggests that engagement is comprised of productive activities and interpersonal relationships there has been little agreement on which type of activity contributes the most to overall engagement, and is most important in influencing cognitive and physical function. Data were collected on approximately three hundred, English- speaking older adults between the ages of 55 and 90 years (mean = 68.7 ± 8.09 years). The questionnaire assessed the participants' frequency of participation in the four types of engagement over a seven-day recall period (1 = daily to 4 = never). Participants were also asked to rate their ability to perform a series of seven tasks to determine their physical function and four tasks to determine their cognitive function. In terms of the patterns of engagement, the older adults reported the highest level of engagement in passive leisure activities (M = 2.66 ± 1.19), followed by productive (M = 2.87 ± 1.37), social (M = 2.94 ± 0.83), and active leisure activities (M = 3.25 ± 1.06). This sample of older adults had high levels of physical (M = 1.52 ± 0.97) and cognitive (M = 1.55 ± 0.74) function. These data suggest that older adults who are engaged in a variety of activities on a weekly basis are maintaining their cognitive and physical function. Future analyses and research will examine the contribution of each type of engagement to an overall "engagement" variable which will then be used to develop predictions of cognitive and physical function. This work will be beneficial for developing public health messaging targeting interventions for older adults aimed at maintaining functional independence.

Grunting in tennis: Distraction or masking?

Lim, Ahnate, University of Hawaii at Manoa; Kingstone, Alan, University of British Columbia; Sinnett, Scott, University of Hawaii at Manoa

Anecdotal evidence from professional tennis players and fans suggests that excessive grunting can hinder an opponents' performance. Recent research corroborated this by showing detriments in both accuracy and reaction time when judging the direction of a tennis shot accompanied with a grunt (Sinnett & Kingstone, 2010). This previous example used silent videos as opposed to natural sounding videos, and compared these to a condition that included extraneous sound played over the impact point (i.e., analogous to a grunt). However, it is possible that silence masks important auditory cues in the video, thereby preventing the integration of multisensory events. We compared the previous research's silent condition with natural sounding videos to assess whether they are perceived differently. Participants watched videos of a professional tennis player and as quickly as possible, judged the direction of a tennis shot struck to either the left or right side of the screen. The videos were played in silence, or included the original sound track (i.e., natural sound). In a second experiment, an additional sound (grunt) was placed either before, during, or after impact, in addition to an equivalent amount of videos played in silence. No differences were observed between the sound conditions, indicating that the adverse effects of grunting seem to be related to general distraction. This was replicated when manipulating the frequency of the grunts to occur 75% of the time. Furthermore, in the high frequency condition overall performance improved, suggesting that the predictability of the grunt is important, with more sporadic grunting leading to diminished performance. This conclusion is supported by the fact that there was no difference between the 75% grunt condition and the no sound condition. The findings will be discussed in relation to current theory on multisensory integration.

How can we run longer? The effect of music on exercise performance

Lin, Ju-Han; Chen, Chih-Chan; Liu, Ting-Kuang, National Dong Haw University, Taiwan

The purpose of this study is to investigate the effect of music on aerobic exercise. This study was divided into two parts. First, there was a 12-min period of cycling in 4 conditions (music, video, music and video, and control). Twenty collegiate students participated; their heart rate and perceived exertion were measured. Second, 75 collegiate students took the Brunel Music Rating Inventory (BMRI) scale measurement in order to understand the effect of music preference on level of excitation (i.e., heart rate increase). These 75 collegiate students were further divided into 5 groups (high preference and high excitation, high preference and low excitation, low preference and low excitation, low preference and high excitation, and control). Each person underwent a 12-minute running test. The results showed that the different media had no effect on the change in heart rate, but when the media were provided, the perceived exertion was lower. Furthermore, the music condition had a lower perceived exertion rate when compared to the video condition. In addition to the effect of media, this study also showed that the effect of music preference has an effect on exercise performance. In sum, we suggest that not only the presence of media but also the preference for the media mediate exercise performance.

The effects of tai chi guan on inhibitory functioning: Evidence from the stop signal task

Liu, Suyen; Ruo, Tien-You; National Chung Cheng University

The ability of response inhibition is a part of human cognitive function which represents the immediate transformation of personal idea and the ability of behavior adjustment to adapt to new situations. This kind of situation of adaptation process for new circumstances is often referred to as cognitive control. Research has showed that Tai Chi Chuan has resulted in physiological or psychological benefits but little evidence to learn Tai Chi Chuan affecting on cognitive function. This study tested whether subjects engaged Tai Chi Chuan show different brain activation in stop signal task while compared with subjects never participate in Tai Chi Chuan, but have regular exercise habits; and non-exercise subjects by NeuroScanSynamps. The purposes of this study had twofold: 1. The differences of GO reaction time, stop signal reaction time in stop signal task among Tai Chi Chuan group, exercise group and non-exercise group. 2. The differences of the ERPs data of cortex when performed the stop signal task among Tai Chi Chuan group, exercise group and non-exercise group. Methods: 20 mid-aged subjects were randomly assigned into 3 groups: Tai Chi Chan group (53.13 ± 3.14 years), exercise group (55.13 ± 2.94 years) and non-exercise group (54.65 ± 3.70 years) and were asked to perform the signal stopping examination with Neuroscan EEG hat; meanwhile. The brain waves information and behavior data were recorded simultaneously. Results: 1. The performance of SSRT was significant better in Tai Chi Chuan group and exercise group than the non-exercise group. 2. Tai Chi Chan group has greater P3 and amplitude in Stimulus lock, success inhibition and failure inhibition. 3. Tai Chi Chuan group has shown bigger Pe amplitude after inhibition error. Conclusions: In behavior data, Tai Chi Chuan group and exercise group showed a shorter time in GO reaction time and Stop signal reaction time than non-exercise group. It indicated that those who engaged in Tai Chi Chuan and regular exercise benefits cognitive execution. In ERPs data, Tai Chi Chuan group performed more resources in forehead while response inhibition executed. One of the intrinsic nervous operations may invest more attention resources of Tai Chi Chuan group in inhibiting situation, and in failure of inhibition situations, there is a better ability to regulate wrongdoing and to improve the attention of the incorrect behavior and alert.

A cross-cultural validation of Middleton's Mental Toughness Inventory

Lo, Wen-Chieh; Lu, Frank J. H.; Wang, Erica T. W.; National Taiwan Sport University

The purpose of this study was to validate Middleton and colleagues (Middleton, Marsh, Martin, & Richards, 2004) Mental Toughness Inventory (MTI) into Chinese version. Middleton and colleagues defined mental toughness as an unshakeable perseverance and conviction towards some goals despite pressure or adversity. Middleton et al. (2004) and conceptualized mental toughness with 12 components including: self-efficacy, potential, mental self-concept, task familiarity, value, personal bests, goal commitment, perseverance, task focus, positivity, stress minimization, and positive comparisons. In this study, we used back-translation making a Chinese MTI draft and administered to 302 Taiwanese intercollegiate athletes (males = 191; females = 111; M_{age} = 19.67, SD = +1.51). With item discrimination analysis exploratory factor analysis (EFA), and Cronbach alpha coefficients analyses, we found Chinese version of MTI emerged 5 factors named "do one's best attitude," "strong self-belief," "positive comparisons," "resilient under stress" and "positive values and beliefs toward sports", and Cronbach's alpha ranging from .87 to .92 with total accounted variance is 72.87%. We suggested that future study may validate Chinese MTI with confirmatory factor analysis (CFA) or other related research.

Motivational climate, self-determined motivation and competitive anxiety in Pan American gymnasts

Lopez-Walle, Jeanette; Pineda, Antonio; Tristan, Jose; Universidad Autónoma de Nuevo Leon; Balaguer, Isabel, Universitat de València

The antecedents of anxiety in sports have been studied extensively, the evidence suggests that personal, environmental, and team factors may represent a source of anxiety in athletes (Woodman & Hardy, 2001). The purpose of this study was to analyze from the perspective of Achievement Goals Theory (Ames 1992; Nicholls, 1989) and Self-determination Theory (Deci & Ryan, 1985; Ryan & Deci, 2000), the interrelationship between the dimensions of perceived motivational climate, self-determined motivation and competitive anxiety (somatic, and cognitive anxiety and self-confidence). A multi-section questionnaire was administered to 60 artistic gymnasts, men and women, (M_{age} = 20.84, SD = 3.82) who participated in the 2011 Pan American Games in Mexico, who completed the Spanish versions of the following questionnaires: The Perceived Motivational Climate in Sport Questionnaire (Newton et al., 2000; Balaguer et al., 1997), the Sport Motivation Scale (Pelletier et al., 1995; Núñez et al., 2007) and the Revised Competitive State Anxiety Inventory-2 (Cox et al., 2003; Andrade et al., 2007). The results confirmed the theoretical factors for each of the questionnaires, and offered an adequate reliability (α = .70 to .89). Regression analysis indicated that the perceived task involving motivational climate was a positive predictor of self-determined motivation (β = .30, p < 0.031), and this in turn negatively predicted somatic anxiety (β = -.293, p < .05) and positively predicted self-confidence (β = .536, p < .01). Results revealed no direct links between motivational climate and any factor of competitive anxiety. These results support the importance of creating environments that promote self-determined motivation, which in turn could be contributing in some degree to the perception of low competitive anxiety.

Prediction of adolescents' participation in physical activities: The roles of peer norm and self-efficacy

Lu, Frank J. H.; Wang, Erica T. W.; Wu, Chi-Hung, National Taiwan Sport University

Although many studies suggest that self-efficacy is the strongest predictor of physical activity in most population (Sallis & Owen, 1999; Trost, Owen, & Bauman, 2002), some researchers suggest that peer norms may influential in predicting healthy behavior (Azjen & Fishbein, 1979; Berndt, 1979). In line with such arguments, the purpose of this study was to examine how adolescents' self-efficacy and peer norm predicting leisure time physical activity. Also, we intended to examine whether self-efficacy mediating the relationships of peer norm and physical activity. Two hundred and forty junior high school students (Male = 124; Female = 116; M_{age} = 15.29, SD = ±.57) completed International Physical Activity Questionnaire (IPAQ), Perceived Self-Efficacy Scale in Physical Activity (Wu, Pender, & Noureddine, 2003) and The Modeling of Physical Activity Scale (Wu, Pender, & Noureddine, 2003). Hierarchical regression analysis found although social norm accounted greater variance in adolescents' physical activity (R^2 = .10) than self-efficacy (R^2 = .04), self-efficacy fully mediated the relationship between peer norm and physical activity. Results suggested that when initiating an exercise program for adolescents health practitioners should not ignore the influence of self-efficacy and peer norm on adolescents' physical activity participation.

The role of high school physical activity mode on college students' motivation for physical activity

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The transition from high school to college presents new challenges that may impact health behaviors including physical activity (Racette et al., 2005). However, the role of past physical activity experience in predicting whether physical activity behaviors will be maintained, increase or decrease across the transition to college has received little research attention. Self-determination theory (SDT) proposes that physical activity behaviors are more likely to be sustained if the underlying motivation regulating the behavior is more self-determined in nature (Ryan & Deci, 2007). Furthermore, feelings of competence and autonomy have been shown to be central to supporting more self-determined motivation (e.g., Wilson & Rogers, 2008). The purpose of this study was to test the role of physical activity mode during high school in predicting the degree to which students feel competent and autonomous with regard to physical activity during college and thus more self-determined in their motivation. First year college students (N = 124; M_{age} = 18.42, SD = .51) completed a survey assessing the amount of time they spent engaged in different modes of physical activity during their senior year of high school (retrospectively), and feelings of competence, autonomy and motivation regulations for physical activity presently in college. Physical activity mode included competitive sport, recreational sport, aerobic exercise, resistance exercise, organized activities and recreational activities. Path analysis results showed that participation in competitive sport and resistance training positively predicted ($p < .01$) feelings of competence (R^2 = .31) and competitive sport participation positively predicted autonomy (R^2 = .13). In addition, perceived competence and autonomy mediated the relationships of competitive sport participation and resistance training to self-determined motivation (R^2 = .28). Results suggest that prior experience in these types of physical activity is important for future participation due to their role in supporting more self-determined motivation.

A daily analysis of physical activity and satisfaction with life in emerging adults

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Satisfaction with life (SWL) has been related to peoples' physical and mental health and appears to be a key determinant of happiness throughout the lifespan (Pavot & Diener, 2008). Emerging adulthood is a particularly important stage for studying SWL because people's global evaluations of their well-being appear to worsen more from ages 18 to 25 years than any other time in the adult lifespan (Stone, Schwartz, Broderick, & Deaton, 2010). Understanding the factors that influence daily SWL is an important first step for explaining these age-related differences during emerging adulthood. In this study, we investigated top-down (i.e., trait-level, time-invariant) and bottom-up (i.e., state-level, time-varying) influences of physical activity (PA) on daily SWL. A daily diary study lasting 8 days was conducted with a sample of emerging adults (N = 190) enrolled in college to evaluate relations between daily PA and SWL while controlling for established and plausible top-down and bottom-up influences on SWL. Participants provided data for a total of 1,506 of the 1,520 possible person-days (99% response rate). On average, participants reported moderate SWL (M = 4.10), but ratings fluctuated considerably within-person from day-to-day (ICC = .28). On average, participants' overall level of PA (M = 12.67) was equivalent to slightly more than two moderate-intensity bouts of activity per day. Results from a multilevel analysis indicated that while trait levels of PA were not associated with SWL (between-person effect), people reported greater SWL on days when they were more physically active (within-person effect). These associations were robust when we controlled for other trait-level (e.g., sex, personality traits, self-esteem) and state-level (e.g., daily self-esteem) influences. We concluded that SWL was impacted by people's daily/state PA rather than their average/trait level of PA. These findings extend evidence that PA is a health behavior with important consequences for daily well-being and should be considered when developing national policies to enhance SWL.

Processing fluency effects influence obese pregnant women's perceptions of a community lifestyle program

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It is believed that the fluency and ease with which instructional information is processed leads to the assumption that the instructions themselves will be easy to follow and implement in practice (e.g., Song & Schwartz, 2008; 2009). Such processing fluency effects may directly influence participant recruitment processes for interventions designed to encourage the adoption of healthy behaviors (e.g., physical activity). The current study aimed to identify the most suitable way to deliver written instructions about a community lifestyle program for obese pregnant women via a participant information sheet. This cross-sectional study consisted of obese pregnant women (n = 35) and student midwives (n = 36). Participants were randomly assigned to one of four experimental conditions and presented with the appropriate experimental stimuli (i.e., example information sheet for a community lifestyle program). The title of the community lifestyle program and the font type in which the information sheet was presented were manipulated in order to create the four experimental conditions (i.e., Double-Fluent; Double-Awkward; Fluent Title-Awkward Font; Awkward Title-Fluent Font). After reading the information sheet, participants rated their perceptions of the program (e.g., familiarity, attractiveness, complexity) using five-

point Likert scales. A 4 × 2 factorial multivariate analysis of variance (MANOVA) revealed that whilst no significant differences were identified for student midwives' ratings across the four experimental conditions, pregnant women rated the Double-Awkward condition as significantly more complex than both the Double-Fluent (p = .024) and the Awkward Title-Fluent Font (p = .021) conditions. The present research findings have direct implications for the construction and presentation of participant information sheets to ensure the effective and ethical recruitment of participants.

Autonomy support and empathy among coaches

Markland, David; Han, Christie; Bangor University

The quality of the coach-athlete relationship has been identified as critical to athletes' motivation. According to self-determination theory, a key motivational factor in this relationship is the extent to which coaches provide support for athletes' autonomy. Implicit in the concept of autonomy support is the ability to empathize with others. This study examined the relationships between coaches' self-reported autonomy supportiveness, athletes' ratings of their coaches' autonomy support, and coach empathy. Forty-four coaches completed self-report measures of their perceived autonomy supportiveness and their ability to empathize, and an objective test of their ability to correctly identify others' emotional states. 162 athletes (between two and six per coach) completed a measure of their coaches' autonomy supportiveness. A multi-level model with athletes nested within coaches failed to converge on a solution. Consequently, athlete autonomy support ratings were aggregated within coaches. Coach and athlete reports of autonomy support were significantly correlated (r = .52, p < .01). Squared semi-partial correlations showed that coaches' self-reports of autonomy support significantly predicted their self-reports of empathy (hat p^2 = .17, p < .01) but not their empathy ability test scores (hat p^2 = .07, p > .05). Conversely, athletes' reports of their coaches' autonomy support significantly predicted coaches' performance on the objective empathy test (hat p^2 = .18, p < .01) but not coaches' self-reports of empathy (hat p^2 = .00, p > .50). Coaches' self-reports of empathy were not significantly correlated with their performance on the objective test (r = -.06 > .50). Results suggest that coaches' self-report ratings of their empathic ability cannot be taken as accurate measures of their actual ability. Furthermore, although there is some overlap between coach and athlete reports of coaches' autonomy support, athletes' ratings may provide more accurate assessments of coaches' autonomy supportive behaviors than coaches' self-reports of their own behaviors.

Effects of video game play on snacking behavior, mood, physiology, and caloric burn: Nintendo WII VS. Microsoft X-Box

McCombs, Kristin; Bloom, Jared; Hunker, Ryan; Raudenbush, Bryan; Wright, Tim; Wheeling Jesuit University

Prior research has investigated the link comparing childhood obesity with activity participation, television viewing, and video game use. The current study compared snacking behavior, mood, physiology, and caloric burn between the Nintendo Wii and the Microsoft X-Box gaming systems. Each participant played a boxing game on both the Wii and the X-Box and completed a control condition where no game was played. During play, participants wore an Actiwatch monitor, which measured their movement and caloric expenditure. The results showed that there was a significantly higher blood pressure and pulse with the Wii than with either the X-Box or control conditions. Furthermore, there were greater total

and mean activity (movement) scores in the Wii condition which led to a greater caloric expenditure. Finally, when a snack food (M&Ms) was available during game play, those participants in the Wii condition ate the least amount of the snack. These results are particularly salient regarding the positive benefits of video game play, the reduction of snacking behavior during certain gaming conditions, and the possibility of weight loss through games requiring additional physical activity.

Effects of Wii tennis game play on pain threshold and tolerance

McCombs, Kristin; Kolks, Jonathan; Hamilton-Cotter, Alexandra; Raudenbush, Bryan; Wheeling Jesuit University

Previous research has shown psychological and physical benefits can be gained by playing video games, such as a distraction from pain and maladaptive behaviors, and can facilitate social engagement. The current study examines whether the Nintendo Wii tennis video game can serve as a distraction from pain perception and increase tolerance. Participants completed each of two conditions: a session in which Wii Tennis was played while immersing their non-dominant hand in a cold pressor tank and a session in which no game was played while the non-dominant hand was placed in the cold pressor. Participants were able to tolerate the pain significantly longer in the play condition and rated their pain as less severe. Participants reported the play condition as more physically and mentally demanding; however, they also rated their performance in that condition higher. Implications for such research include providing an alternative or adjunct to pharmaceuticals for pain management.

A longitudinal examination of four models of hope and self-perceptions in a youth physical activity setting

McDavid, Lindley; McDonough, Meghan H.; Smith, Alan L.; Cooky, Cheryl; Purdue University

A positive relationship between hope and self-perceptions (i.e., domain-specific competence and global self-worth) has been demonstrated in many contexts including physical activity (e.g., Snyder, 2002; Ullrich-French, McDonough, & Smith, in press). However, research on the direction of the hope–self-perception relationship is needed to develop intentional, theory-based interventions in physical activity contexts. Hope theory (Snyder, 2002) suggests that hope should facilitate self-worth. Conversely, Harter's (1999) theory of the self suggests that self-worth should predict affective and cognitive outcomes such as hope. Furthermore, there is evidence of a bidirectional relationship between global self-worth and domain-specific competence (Kowalski et al., 2003). This study tested four alternate models: (1) hope– > domain-specific competence– > global self-worth; (2) hope– > global self-worth– > domain-specific competence; (3) global self-worth– > domain-specific competence– > hope; and (4) domain-specific competence – > global self-worth– > hope. $N = 363$ low-income youth ($M_{age} = 10.23$) from a physical activity-based summer program participated in the study. Surveys were administered 5-6 weeks prior to, and at the beginning and end of the four-week program. Cross-sectional analyses revealed that the second model best fit the data (RMSEA = .07; CFI = .94; SRMR = .05). However, the fourth model was also partially supported. Longitudinal analyses that controlled for autoregressive effects showed that global self-worth predicted subsequent perceptions of hope ($\beta = .23$-$.24$) but that hope did not significantly predict subsequent global self-worth perceptions (RMSEA = .05; CFI = .95; SRMR = .06). Consistent with previous research, there was evidence of a

bidirectional relationship between global self-worth and domain-specific self-perceptions. Findings support the model based on Harter's theory in that self-worth positively predicted hope. These findings help lay the groundwork for future theory-based interventions.

Participant reflection on character concepts taught in a physical activity-based positive youth development program

McDonough, Meghan H., Purdue University; Ullrich-French, Sarah, Washington State University

This study examined perceptions and perceived effects of the character development curriculum in a 4-week physical activity based summer positive youth development program for low-income youth. Each week one of four character concepts (respect, caring, responsibility, trust) was incorporated into physical and life skills activities throughout the program. The purpose of this study was to examine program participants' understandings of the character concepts, perceptions of the character development activities, and perceptions of the relevance and effects of the activities in their lives. Semi-structured interviews were conducted with 24 participants at the end of the program. Participants were purposively sampled to include a cross-section of age (range = 9 – 14 years), gender (n = 12 male, n = 12 female), and ethnicity (46% Hispanic, 38% White, 13% Black, 4% Asian). Interviews were transcribed verbatim and content analyzed. Participants reported a general understanding of the character concepts. Four categories represented the ways participants perceived the character curriculum lead to changes in their lives: treatment of others, social relationships, self-perceptions, and hope and possibility. Treatment of others included sharing, being helpful at home, sportsmanship, having empathy and helping others. Social relationships included how the character concepts help them to build relationships with peers, camp staff, siblings, and parents, learning to trust and be trustworthy, learning how to choose friends who treat them well, and learning to cope with difficult peers. Self-perceptions included self-respect, seeing themselves as responsible, and raised self-awareness. Hope and possibility included creating a positive future by setting goals and visioning who they wanted to be, and being open-minded and feeling like they could make a difference in the world. Specific activities that contributed to change in each of the four categories were identified, and practical applications for positive youth development programs are discussed.

The impact of transformational leadership behaviors on self-esteem in the youth expedition context

McElligott, Samantha J.; Arthur, Calum A.; Callow, Nichola; Bangor University

The effects of adventure programs on self-esteem exceed that of other educational programs (Hattie & Marsh, 1997). Despite the importance ascribed to leadership in the expedition contexts (Hattie & Marsh, et al., 1997; Sibthorp, et al., 2007) very little theoretically driven research has examined the impact that leadership has in the expedition context. Transformational leadership has a positive impact in a wide variety of contexts (e.g., Sport, Callow et al., 2009; Military, Hardy et al., 2010); however, it has not been explored in the expedition context. To this end the current study used a transformational leadership framework to explore the impact that leadership has on the development of self-esteem in an expedition context. Data were collected from 393 expedition participants (mean age = 16.80 years, SD = .77) in 46 expedition groups. Given that there is no validated measure of transformational leadership for the expedition context we developed a measure based on Hardy, et al.'s (2010)

conceptualization. Using CFA in an exploratory manner we developed and validated the measure ($N = 638$). The general self-esteem domain of the Self Description Questionnaire III(Marsh, 1984) was administered prior to the expedition and again after the expedition, the expedition transformational leadership inventory was administered halfway through the expedition. After controlling for pre-test levels of self-esteem multilevel analysis (MLwiN) revealed that the following transformational leadership behaviors significantly predicted post-test self-esteem: intellectual stimulation (IS) B = 2.65($SE = .068$), $p < .05$; individual consideration (IC) B = 2.94($SE = .077$), $p < .05$; and inspirational motivation (IM) B = 2.63($SE = .060$), $p < .05$). The results indicate that transformational leadership positively impacts on self-esteem in the expedition setting, and that, specifically, IS, IC and IM are positive predictors of self-esteem.

Motivational characteristics of student-athletes representing a U.S. service academy

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Self-determination theory (SDT; Deci & Ryan, 1985) posits three types of motivation: intrinsic motivation (IM), or action undertaken because it is inherently interesting or enjoyable; extrinsic motivation (EM), action undertaken for external reasons; and amotivation, which is the absence of motivation. Although SDT has been utilized to study motivation in collegiate sport, there are no known studies that address the motivational characteristics of athletes representing U.S. service academies. This population is of interest because every student at a service academy has received a full academic scholarship and cadet student-athletes function in a very demanding and controlled environment with numerous additional academic and leadership responsibilities that extend beyond the normal demands placed upon college student-athletes. In order to contrast motivational characteristics of service academy college athletes with non-service academy college athletes the Sport Motivation Scale (SMS; Pelletier et al., 1995) was administered to athletes representing both types of institutions. The SMS has roots in SDT and was developed specifically to measure motivation in sport. A total of 67 athletes participated in the study (x = service academy athletes, y = non-service academy athletes) and were contrasted on three dimensions of intrinsic motivation (to know, to accomplish, and to experience stimulation), three dimensions of extrinsic motivation (external regulation, internal regulation, and identified regulation) as well as amotivation. Results indicated that non-service academy athletes scored significantly higher on intrinsic motivation to know, $t(65) = -4.216$, $p < .05$ but that no other significant differences existed between the groups. The results of this study suggest that athletes representing service academies do not have motivational profiles that differ markedly from the motivational profiles of non-service academy athletes.

From virtual reality to fitness devices

Mestre, Daniel R.; Pause, Anne-Sophie; Aix-Marseille; Maiano, Christophe; Université du Quebec en Outaouais

Virtual reality (VR) can be defined as a system of technological tools (hardware and software), aimed at enabling a user to carry out cognitive and sensorimotor activities in a virtual environment. Since the early 1990s, VR coupled with an exercise device has been used in fitness and rehabilitation contexts. In such settings, the general objective was to increase user's involvement/adherence toward an exercise. By using a device that diverts attention from unpleasant bodily sensations and thus potentially delaying the onset of boredom and fatigue, one can indeed incite higher involvement. As a consequence, performance and

psychological benefits can be expected. The purpose of this communication is to examine whether the sensorial and virtual reality context has a positive effect on psychological parameters. Specifically, we will present recent results obtained using a computerized ergometer (station bike) coupled to VR software. We tested whether sensorial inputs (music and video feedback) positively affect performance and psychological parameters (e.g., enjoyment, commitment to the task). More precisely, we tested conditions in which the visual feedback was a video film of a course that participants had to complete. Video display speed was proportional to the participant's pedaling speed. Force feedback, applied to the rear bicycle wheel, was proportional to the instantaneous course slope. Exercise intensity was moderate (maximum slope of 6%). Results from experimental studies showed that sensorial inputs trigger significant psychological effects. Adding free listening music to video feedback helped to maintain enjoyment and commitment to the task. However, imposed music had complex effects on performance and affective states, which will be discussed with reference to the current literature. Finally, the long-term effects of VR-augmented feedback on intrinsic motivation and adherence to a fitness exercise remain to be investigated.

Estimation of the relative contributions of constraints to optimal track and field performance

Meyer, Ben, Shippensburg University

Newell (1986) proposed that the primary constraints on movement coordination are organismic, environmental, and task-related in nature. The optimal pattern of coordination for a given activity is determined by the interaction of the constraints. However, the utility of Newell's model to practitioners has been limited by its non-interactive nature. The purpose of this project was to develop an interactive version of Newell's model (in the form of a graphical interface) and use it to test for differences in users' estimates of the relative contributions of constraints to optimal performance in four track and field activities: sprint running, endurance running, throwing, and jumping. Using the graphical interface, participants estimated the relative contributions of constraints to optimal performance for the four track and field activities and assigned a confidence value to their estimates for each activity. The total number of participants was $N = 125$, with 25 members per event group (sprinters, endurance runners, throwers, jumpers, and a group of non-track athletes). A doubly multivariate analysis of variance was used to check for differences between and within members of the event groups in regard to the relative contributions of constraints for the track and field activities. Participants estimated the organismic constraint to be the largest contributor to optimal performance in track and field events, with estimates typically near 50%. The environmental and task constraints were estimated to contribute approximately 25% each. Track and field event groups had the largest confidence in their estimates for their own events, while non-athletes had similar confidence levels across the events. The interactive tool showed utility for the assessment of users' estimates of the constraints that affect human performance.

Self-compassion and the stress process: A prospective study with university athletes

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The construct of self-compassion appears to have potential application in the sport context (Mosewich, Kowalski, Sabiston, Sedgwick, & Tracy, 2011). Self-compassion involves

offering nonjudgmental understanding and compassion to oneself and can help to combat self-criticalness (Neff, 2003). To further understand the role of self-compassion in the sport domain, the present study sought to examine appraisal, coping, affect, and gender in a competitive context in athletes high and low in self-compassion. Ninety male (mean age = 20.0 years, *SD* = 1.5 years) and 99 female (mean age = 19.7 years, *SD* = 1.5 years) varsity athletes completed the Self-Compassion Scale (Neff, 2003). Approximately four weeks later, after a sport competition, athletes completed measures of coping function, positive and negative affect, and items reflecting control, challenge, and threat appraisals. There were no significant gender differences for self-compassion. Using a gender-specific median split for self-compassion, a 2 (self-compassion) × 2 (gender) MANOVA revealed significant main effects for self-compassion (Wilks's $\lambda = .83$, $p < .01$), but no significant main effects for gender or interaction effects. Athletes with higher levels of self-compassion reported higher control (Cohen's $d = .39$) and challenge (Cohen's $d = .38$) appraisals, while athletes with lower levels of self-compassion scored higher on threat appraisals (Cohen's $d = .36$), avoidance coping (Cohen's $d = .50$), and negative affect (Cohen's $d = .64$). Taken together, self-compassion has theoretically and empirically meaningful relations to the coping process, particularly in appraisal, avoidance coping, and negative affect. If properly fostered, self-compassion may have potential as a resource for both men and women athletes. This research was supported by the Social Sciences and Humanities Research Council of Canada.

Affective expectancies and physical activity in children: A review and meta-analysis

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Background: Most health behavior theories do not incorporate an affective component to understanding engagement in behavior. A recent meta-analysis on affective expectancies (AE) and physical activity in adults yielded a relationship with a medium effect size. A similar meta-analysis in children has not yet been completed. Purpose: Studies on children (5-18 years old) which incorporated an AE construct in a physical activity context were reviewed. A meta-analysis was conducted to appraise the effect of AE on physical activity behavior and to detect variables which moderated this effect. Studies were eligible if they included: (a) a physical activity measure; (b) an AE measure; and (c) involved participants with a mean age between 5 and 18 years. Methods: Literature searches were conducted among five key search engines between 1990 and 2011. This search yielded a total of 10332 potentially relevant articles. Of these, 46 fulfilled the eligibility criteria and 9 were retrieved from manual cross-referencing of bibliographies. Fixed and random effects meta-analysis procedures with correction for sampling, measurement, and publication bias were employed. Results: Of the articles included, 40 were correlational, yielding 56 independent samples; and 15 were experimental, yielding 14 independent samples. Sample sizes ranged from 30 to 5563. For the correlational studies, the corrected summary *r* of AE and behavior was .32 (95% CI .30 to .33) and .26 (95% CI .18 to .32) for fixed and random effects, respectively. Significant moderators of this relationship were gender and measure of physical activity. Experimental studies demonstrated that high school-aged students benefitted most from the interventions, especially those conducted on females via a change in curriculum. Conclusion: The results point to a medium effect size relationship between AE and physical activity in children. Interventions on AE are scarce but show promise especially in the high school-aged population. More intervention studies on elementary aged children are needed.

Predicting parental social control: Examination of descriptive norms for sedentary and physical activity

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Health-related social control (SC) is a regulatory influence exerted in response to perceived counter-normative behavior such as an unhealthy behavior (Lewis & Butterfield, 2005). With parents using SC to regulate activity behavior (Wilson & Spink, 2010), one might expect SC use to be related to norms for physical activity. Descriptive norms (DN; what others usually do) are one type of norm that may be salient given its association with various behaviors (Rivas & Sheeran, 2003) including physical activity (Priebe & Spink, 2011). However, the link between norms and social control has yet to be examined. The role of descriptive norms influencing social control is indirectly supported by a positive relationship between parent activity and use of positive and collaborative SC tactics (Wilson & Spink, 2010). With parents using 'screen time' as a cue to exert social control for physical activity (Wilson, Spink, & Brawley, 2010), one might expect norms for sedentary behavior also to be linked to SC use. Given the importance of norms in the definition of social control, this study examined how family physical activity and sedentary descriptive norms influenced SC use. Parents (N = 59), recruited from various children's centers, outdoor events and schools, responded to an online survey that assessed family activity and sedentary DN, and parent's positive, collaborative and negative SC (Wilson & Spink, 2010). Norms explained 24% of the variance in collaborative SC ($p < .001$) with DN for activity ($\beta = .29$, $p = .02$) and sedentary ($\beta = -.37$ $p = .003$) both emerging as significant predictors of collaborative SC. For positive SC, the overall explained 10% of the variance ($p = .05$) with only DN for activity being significant ($\beta = .26$, $p = .04$). Negative social control explained 10% of the overall variance ($p = .05$) with DN for sedentary behavior approaching significance ($p = .06$). The degree to which the parent perceives descriptive norms for activity and sedentary was related to social control exerted suggesting the potential importance of descriptive norms in understanding SC use.

Effects of anxiety, a cognitive secondary task, and expertise on gaze behavior and performance in a far aiming task

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Objective: Previous studies focused on investigating the separate effects of anxiety, cognitive load, and expertise on perceptual-motor performance, but the combined effects of these factors have not been studied yet. The objective of the current study was to investigate these factors in combination. Method: Eleven expert dart players and nine novices performed a dart throwing task in high- and low-anxiety conditions with and without a secondary task (counting backwards). Results: The anxiety manipulation evoked a decrease in dart performance, but only for the novices. Increases in mental effort and dart times and a decrease in response rate on the secondary task were observed for both groups. This shows that there were decreases in processing efficiency with anxiety. Most important, the anxiety-induced decrease in performance for the novices was accompanied by final fixations on the target that were substantially shorter and deviated off the target earlier. The dual task did not affect performance. Conclusion: Anxiety affects efficiency and sometimes performance in far aiming tasks. Changes are accompanied by changes in gaze behavior, particularly the final fixation on the target. All in all, findings provide support for attentional control theory as a suitable framework to explain the effects of anxiety, a cognitive secondary task, and expertise in far aiming tasks.

What happened during student-athletes' career transition?: A social cognitive approach

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Without doubt, career transition has been one of the most critical moment during student-athletes' sport career. What makes their decision and what are the consequences of their decision are important not only in academic domain, but also practical to sport personnel. The self-determination theory (SDT) has been considered as one of the most important theory to study motivation in sport and exercise setting. Not only basic need satisfaction of autonomy, competence and relatedness will influence self-determination form of motivation, but also individuals' achievement goals as well as motivational climate ones' perceived will impact on this motivation regulation. Literature showed with the influential aspect of student-athletes' motivation on their transition decision. A successful career transition will promote not only short-term performance but also long term life-span sport achievement. Therefore, the present study was focused on student-athletes' antecedent factors such as individuals' basic needs and achievement goals, and situational level such as motivational climate to affect their motivation, as well as motivation to promote their well-being and decrease ill-being during their career transition period. Near 400 student-athletes involved in this study after subject consent were collected. A cross-sectional longitudinal design was conducted during 12 months. More the autonomy and competence needs were fulfilled, as well as task-involved climate were perceived, the more self-determination motivation was witnessed. In addition, the degree of self-motivation also related to higher athletes' well-being and lower ill-being such as self-handicap, before their transition, as well as their current life satisfaction. Further discussion were proposed and suggestion regarding motivation empowerment were suggested.

Examining patterns and frequencies of self-reported SDT-based motivations to exercise among different TTM-based stages of exercisers

O, Jenny, California State University, East Bay; Duncan, Lindsay, Yale University; Webb, Shannon, California State University, East Bay

SDT-based exercise psychology literature suggests that, regardless of one's current level of exercise participation, exercise behavior can be increased by increasing more self-determined forms of motivation to exercise (e.g., Ryan & Deci, 2007). Other literature, however, has emphasized the importance of TTM-based stage-matched exercise interventions (e.g., Huang et al., 2009), suggesting that practitioners should consider one's current level of exercise participation when designing an exercise intervention. The present cross-sectional study examined self-reported SDT-based motivations to exercise in exercisers classified into different TTM-based stage of exerciser groups. It was hypothesized that different motivational profiles would emerge dependent on group membership. Participants ($N = 694$) completed the BREQ-2 (Markland & Tobin, 2004) as well as a demographics questionnaire intended to assess participants' current stage of exerciser relative to the TTM (adapted from Milne et al., 2008). Results of profile analysis indicated that exerciser groups differed on pattern, frequencies, and absolute amount of self-reported motivations to exercise. More specifically, groups differed significantly on parallelism ($F(13.94, 2356.22) = 65.74$. $p < .0001$, partial $\eta^2 = 0.28$), levels ($F(4, 676) = 109.20$. $p < .0001$, partial $\eta^2 = 0.40$), and flatness ($F(13.94, 2356.22) = 451.18$. $p < .0001$, partial $\eta^2 = 0.39$). Post hoc analyses (pairwise comparisons; $\alpha = .0008$) indicated that all TTM-based exerciser groups differed significantly from each

other on one or more motivational regulator. The one exception was that the motivational profile of the "Non-exerciser—Intending within 30 days" group did not differ significantly from that of the "Regular exerciser—<6 months" group. Discussion will focus on how practitioners may choose to implement these findings to emphasize specific motivational regulators, relative to one's current stage of exerciser, when implementing SDT-based exercise interventions. Possible future research directions will also be discussed.

Basic need satisfaction, time pressure, and performance in elite golfers

Ohlert, Jeannine; Kleinert, Jens; German Sport University Cologne

According to Vallerand's (2001) Hierarchical Model of Intrinsic and Extrinsic Motivation in Sport and Exercise, social factors influence the satisfaction of three basic psychological needs (competence, autonomy, and relatedness) in a certain situation. In the next stage of the model, need satisfaction determines situational motivation which in turn leads to affective, cognitive and behavioral consequences. The current study aimed to verify the model for selected variables with a sample of elite golfers. It was hypothesized that perceived time pressure from flight partners (as a social factor) would lead to reduced perceptions of the needs autonomy and relatedness (first step). Perceived need satisfaction was then hypothesized to influence the achieved score on the course as a behavioral consequence variable (second step). In total, 92 elite golfers who competed at a pro tournament participated in the study. A questionnaire containing all hypothesized constructs was given to the participants. The achieved score was also recorded. Separate regression analyses were done for the two steps of the model. Results revealed for the first step that time pressure was able to explain 19% of the variance of relatedness and 17% of autonomy. In the second step, 22% of the score's variance were explained by the three basic needs with competence being a significant predictor ($\beta = -.47$) and a tendencial effect for relatedness ($\beta = .23$; $\Delta R^2 = .03$). Perceived autonomy did not influence the score ($\beta = -.06$). When separating the group, for players who preferred not to talk on the course, only competence accounted for 20% of the score's variance. For players who liked to socialize on the course, relatedness added a significant effect ($\beta = .27$; $\Delta R^2 = .06$) to the influence of competence on the score ($\beta = -.46$; total $R^2 = .24$). However, the relatedness result was contrary to the expected direction: Players who reported higher satisfaction of relatedness needs showed worse scores. It seems like satisfying the need for relatedness on the golf course interferes with focused playing.

Relationship between cohesion and subjective and objective performance in German tennis teams

Ohlert, Jeannine, German Sport University Cologne

According to the meta-analysis of Carron et al. (2002), cohesion and performance are mostly positively correlated. However, most studies to date are based on interactive teams. The aim of the current study was to examine the relationship between cohesion and subjective and objective performance in tennis teams. Furthermore, several studies point out that cohesion seems to be more important on lower levels of performance. Therefore different levels of performance were also incorporated. In total, 509 tennis players (39% female) participated in an online survey. The questionnaire was administered close to the end of the tennis team season and promoted via several social networks. Almost 40% of the players ($n = 183$) competed on regional level, in each case 29% ($n = 138$) on district level and on state level, and 17 on national level. Cohesion was measured via the German KIT-L (Ohlert,

2012) which is suitable for both interactive and coactive teams. Subjective performance was assessed on a ten-point scale indicating to what extend the player was able to exploit his or her full potential. To measure objective performance, players should indicate the rank of their own team within the respective league. For the whole sample, correlation analyses revealed only small correlations between the four factors of cohesion and performance measures. Highest values were achieved for the factor GI-T and the objective performance of the team (r = -.16). When examining the relationship only for state level players, correlations were all close to zero. For players on district and regional level, correlations were small to moderate and reached significance especially for the factor GI-T. However, for players on national level, correlation between ATG-S and the ten-point scale was at -.49 (p = .06), indicating that lower ATG-S values were linked to better performance. Even though the sample of national players was very small, results might lead to the conclusion that cohesion plays only a minor role in German tennis teams and can even be negatively related to performance in elite sports.

The role of narcissism in moderating the relationship between youth athletes' perceived motivational climate and acceptance towards cheating

Ong, Chin-Wei, Bangor University

The existence of interindividual variability of sport teams' perceived motivational climate had resulted in observed differences in outcome variables at both individual and team levels. Studying individual differences among team members could offer a potential explanation for these differences (Duda, 2001). The present study aimed to investigate the potential moderating role of narcissism on the relationship between youth athletes' perceived motivational climate and their acceptance towards cheating. Youth athletes (male = 128, female = 70) from a sports academy (mean age = 13.23 ± 1.21 years) completed the Motivational Climate Scale for Youth Sports (Smith, Cumming & Smoll, 2008), Narcissistic Personality Inventory (Raskin & Terry, 1988), and the "Acceptance Towards Cheating" subscale of the Attitudes to Moral Decision-Making in Youth Sport Questionnaire (Lee, Whitehead, & Ntoumanis, 2007). Analyses were conducted separately for task and ego climates. Moderated hierarchical regression revealed non-significant main effects for task (β = -.15, ns) and ego motivational climates (β = .13, ns) in the first step, while narcissism accounted for significant variance in the second step over task (ΔR^2 = .04, $p < .01$; β = .44, $p < .01$) and ego motivational climate (ΔR^2 = .03, $p < .05$; β = .40, $p < .05$). Task climate × narcissism (β = .07, ns) and ego climate × narcissism (β = .11, ns) in the third step showed that narcissism did not moderate the relationship between motivational climate and acceptance towards cheating. The results indicate that narcissism predicts acceptance toward cheating independent of the motivational climate promoted by the coach. Narcissists' willingness to accept cheating may be motivated by their need to achieve personal goals of self-aggrandizement.

A novel insight of barriers and contributors for physical activity and exercise in the African American female community

Oregon, Evelyn M.; Beckles, Joelle; Ewing, Martha; Michigan State University

The results of previous research suggest that physical inactivity is more prevalent among racial and ethnic minorities than among Caucasians (Crespo, Smit, Andersen, Carter-Pokras, & B. E. Ainsworth, 2000; Humbert, 2006). Conspicuously absent from the research has been the barriers that may be unique to African American females as well as factors that

contribute to their engagement in physical activity. Thus, the purpose of this study was to provide an in-depth analysis of specific barriers and contributors to physical activity and exercise that may specifically apply only to the African American female community. Participants ranged in age from 25-31 years and were single, diverse in weight, body types, exercise regimens, and careers. A unique approach including individual interviews plus a focus group was chosen for data collection. Interviews provided a depth of information with respect to each individual, whereas the focus group allowed for breadth and richness from participant interaction (Fontana & Frey, 2000; Morgan, 1998). The interview guide of open-ended questions was developed in consultation with experienced researchers in the areas of physical activity, sport, and sociology. The focus group guide was developed based on interview questions and preliminary analysis of major themes from individual interviews, and served as a means to challenge, explore, and extend preliminary understandings of the data. Overall, the results of the analysis revealed four major barrier themes of self-constructed barriers, high self-concepts, programming issues, and lack of health knowledge. The participants identified media portrayal, social pressure, and program recommendations as three themes that contributed to their participation in physical activity. These themes will be discussed in light of their uniqueness to the African American women as well as implications, and potential strategies, for encouraging greater participation.

The relationship between passion for exercise and exercise dependence

Paradis, Kyle F.; Cooke, Lisa M.; Martin, Luc J.; Hall, Craig R.; Carron, Albert V.; University of Western Ontario

Passion is defined as "a strong inclination toward an activity that people like, that they find important, and in which they invest time and energy" (Vallerand et al., 2003, p. 757). Passion is conceptualized as dualistic comprised of harmonious passion which "results from an autonomous internalization of the activity into the person's identity" (Vallerand et al., 2003, p. 757), and obsessive passion which "results from a controlled internalization of the activity into the one's identity" (Vallerand et al., 2003, p. 757). Vallerand et al. (2006) pointed out that researchers in sport and exercise psychology have examined various constructs that would seem to be related to passion, one of these being exercise dependence. This is defined as "a process that compels an individual to exercise in spite of obstacles, and results in physical and psychological symptoms when exercise is withdrawn" (Smith et al., 1998, p. 66). Terms frequently used to illustrate this construct are addiction, commitment, and excessive (Hausenblas & Symons-Downs, 2002). The purpose of the present study was to determine whether individuals who demonstrated a passion for exercise also possessed characteristics of exercise dependence. Participants were 480 (n = 205 male, n = 275 females; Mage = 18.58; SD = 1.66) kinesiology students from an Ontario university. Those involved reported various forms of moderate to vigorous exercise (e.g., cardio, weights). All participants completed the Passion Scale (Vallerand et al., 2003) and the Exercise Dependence Scale-Revised (Hausenblas, Symons-Downs, & Nigg, 2004). Seven stepwise multiple regression analyses were conducted. Results revealed that obsessive passion was a significant predictor for all seven dimensions of exercise dependence (tolerance, withdrawal, intention effects, lack of control, time, reduction in other activities, and continuance). In addition, harmonious passion was a significant predictor for two dimensions of exercise dependence (tolerance and time). Implications for harmonious and obsessive passion for exercise are discussed.

A comparison of coaches' and athletes' transformational and transactional leadership behavior

Paradis, Kyle F.; Martin, Luc J.; Carron, Albert V., University of Western Ontario

The application of transformational leadership theory to the sport and exercise psychology domain has recently garnered research attention (e.g., Beauchamp et al., 2007, 2010, 2011). According to Bass (1985), transformational leadership exerts influence by elevating followers' goals, and providing them with confidence to go beyond minimally accepted standards. Historically, research in sport has focused on more of a transactional type of leadership whereby the leader exerts influence on followers by setting goals, providing feedback, and exchanging rewards for achievement. This approach to the study of leadership in sport had been well established via the work of Chelladurai and his colleagues based on the Multidimensional Model of Leadership (MML; Chelladurai, 1978) and operationalized using the Leadership Scale for Sports (LSS; Chelladurai & Saleh, 1980). Recently, Chelladurai (2001, 2007) proposed that the addition of transformational leadership to the MML was warranted to better understand the influence of leaders on member behaviors. The primary purpose of the present study was to determine the main sources of transformational leadership behaviors in sport. Team members rated the degree to which both coaches and athlete leaders provided various manifestations of transformational leadership. Two secondary purposes were to determine the relative magnitude to which coaches and athletes exhibited each type of transformational behavior. Participants were 300 varsity and club athletes (n = 133 males, n = 167 females). Participants completed the Differentiated Transformational Leadership Inventory (DTLI; Callow et al., 2009) which is a sport specific measure of leadership. Results indicated that coaches and athletes provided inspirational motivation to the greatest degree followed by contingent reward, then individual consideration, and finally intellectual stimulation. In addition, coaches provided these behaviors to a significantly greater degree more than athlete leaders. Implications of transformational leadership from coaches and athletes are discussed.

The coach as a moral influence: A review of literature

Pelaez, Sandra, Concordia University; Aulls, Mark W., McGill University; Bacon, Simon L., Concordia University

Although previous scholars have referred to the role of the coach as a moral influence for the athletes (Weiss, Smith, & Stuntz, 2008), there are no works that have solely and purposefully reviewed this topic in-depth. Thus, the purpose of the present review was to conduct a purposeful (Suri & Clarke, 2009) and interpretive (Eisenhart, 1998) review addressing the role of the coach as a moral influence for athletes. We carried out inductive analysis through two main techniques: constant comparison to synthesize the results of the reviewed studies and content analysis to gain insights into the quality of the results. 36 studies were included in the current literature synthesis. Results indicated that there is a trend suggesting that coaches are moral influences for their athletes. The coach morally influences the athletes through four main strategies: (a) modeling, (b) the creation of a socio-moral environment, (c) teaching moral skills and values, and (d) thorough discussion with the athletes about moral issues. Evidence showed that in general, coaches promoted positive moral behavior during training; however, sometimes, the need and attitude to "win-at-all-costs" led coaches to transmit a different message to the athlete. An in-depth analysis of the quality of the reviewed literature provides as well context for interpretation of the main results. This review

suggests that in order to fully assume their moral responsibilities, coaches may have to: (a) be sensitized about the moral role they play and (b) be aware of the impact their attitudes and behaviors (e.g., "win-at-all-costs") have on the athletes.

Morality in sport: An educational intervention tailored for coaches

Pelaez, Sandra, Concordia University; Aulls, Mark W., McGill University; Harvey, William J., McGill University

Sport is a setting where positive youth development may occur; however, youngsters' sport experience has to be appropriately designed with this purpose in mind. Despite the fact that literature has identified coaches as major moral influence for athletes, coaches recently reported their background concerning sport moral issues was limited. Evidence suggests educational interventions have been found to be an effective tool for promoting changes in coaches. For that reason, an educational intervention, tailored for coaches, that tackled moral issues in sport, was designed to address morality in coaching. Ten basketball coaches, coaching in a community sport league, participated in a three-meeting intervention. The intervention was built upon the situational learning approach (Lave & Wenger, 1991) and sport-specific material (e.g., Gilbert & Trudel, 2005). In the first meeting, the bases for understanding morality were explored. In the following meetings, the influence the coach has on the athletes, motivation, and communication were discussed. We aimed at providing a moral approach suitable to and applicable in daily coaching practices. Post-intervention appraisals were conducted in different forms (e.g., verbal shared brainstorming). Coaches' suggestions were used to both guide consequent meetings and provide general feedback on the intervention. Results suggest this pilot intervention led coaches to have: (a) an increased awareness of potential moral issues that may arise in sport, (b) a better moral understanding and judgment of different sport situations, and (c) a strengthened self-reported confidence to approach different issues related to coaching, from a moral frame. The coaches realized many coaching-related issues could be faced from a moral perspective that, in turn, may improve and enhance youth sport experiences. Our results suggest coaches may benefit from specific practical oriented educational interventions aiming at fostering coaches' moral understanding and practice.

Athletic trainers and athletes don't see eye to eye when it comes to imagery content: The factor structure of the Imagery Use by Athletic Trainers Questionnaire (IUATQ).

Perreault, Melanie E.; Monsma, Eva V.; University of South Carolina; Gay, Jennifer L., University of Georgia; Seiler, Brian D., University of South Carolina

The development of athletes and athletic trainers are similar in that both involve performance of physical skills under high stakes situations and decision making under dynamic conditions. Accordingly, it is reasonable to assume that both populations use imagery content encompassing cognitive (e.g., imaging skills – CS, and strategies – CG) and motivational functions (e.g., imaging goal attainment – MS, mastery performances – MGM, and excitement – MGA). Based on the correlation magnitudes (range .59 to .83) of two recently completed studies (Monsma et al., 2011; Seiler, Monsma, & Perreault, in progress), the aim of this study was to confirm the factor structure of an imagery use questionnaire adapted for a population of athletic trainers, and modeled after one prevalently used with athletes and previously adapted for other non-athlete populations. Male (n = 105) and female (n = 85) athletic training participants, ranging in experience and employment settings completed the

Imagery Use by Athletic Trainers Questionnaire (IUATQ), a context specific modification of the Sport Imagery Questionnaire (SIQ). Using confirmatory factor analysis, the measurement model produced acceptable factor loadings for all variables. The GFI, NFI, and CFI were strong with values > 0.90. The SRMR indicated fair model fit (0.073). The RMSEA (0.094) was greater than the ideal cutoff of 0.05 and less supportive of model fit. Strong factor correlations (> 0.90) existed among the CG, CS, and MGM constructs, suggesting that this sample may consider these to be equivalent constructs. This was the first known CFA of a SIQ modification instrument. Athletic trainers do not seem to differentiate between imagery content specific to athletic training skills, strategies, and mastery performance as captured by the IUATQ. Further inquiry of the image content used by this population is necessary in order to develop assessment tools that can perpetuate imagery research and practical application with athletic trainers.

I think, therefore I am: The addition of athletic identity to the health action process approach predicts sport participation for individuals with acquired physical disabilities

Perrier, Marie-Josee; Latimer, Amy E.; Sweet, Shane N.; Queen's University; Strachan, Shaelyn M., University of Manitoba

Participation in moderate-vigorous leisure time physical activity (MV-LTPA) can help mitigate the negative health outcomes associated with physical disability. Sport is a promising source of MV-LTPA for people with acquired, physical disabilities because individuals who participate in sport are active for longer durations as well as active at higher intensities than their peers who participate in other forms of LTPA. However, estimates suggest that approximately 3-8% of people with disabilities currently participate in sport. Therefore, theory-based interventions are needed to foster sport participation. As a precursor to intervention development, the current study a) tested the fit of the Health Action Process Approach (HAPA) model for sport participation for individuals with acquired, physical disabilities (e.g., spinal cord injury, amputation) and b) examined the extent to which athletic identity predicts intentions to engage in sport within the context of HAPA. A prospective cohort composed of 201 individuals with acquired, physical disabilities was recruited. The HAPA constructs (outcome expectancies; risk perceptions; task self-efficacy; intentions; action and coping planning; and maintenance self-efficacy) and athletic identity were assessed at baseline. Sport participation was assessed by the LTPAQ-SCI 2 weeks later. A structural equation model explained 15% of the variance in sport participation and 18% with the addition of athletic identity ($p < 0.0001$). Instrumental, affective, and negative outcome expectancies were significant predictors of intentions ($\beta = 0.26$; $\beta = 0.22$; $\beta = -0.24$; $p < 0.01$), as was athletic identity ($\beta = 0.25$; $p < 0.01$). Intentions significantly predicted planning ($\beta = 0.56$; $p < 0.01$) yet there was no direct relationship between planning and sport participation ($\beta = 0.01$; $p > 0.05$). When the relationship between planning and maintenance self-efficacy was reversed, planning had an indirect effect on sport participation through maintenance self-efficacy ($\beta = 0.24$; $p < 0.01$). HAPA constructs may be useful aspects to target within the context of sport promotion and athlete development programs for this population; in conjunction, finding ways to foster athletic identity may further encourage maintained participation.

A qualitative examination of athlete leadership behaviors in the dyadic sport of ice dancing

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An athlete leader is defined as an athlete occupying a formal or informal role influencing team members toward achieving a common goal (Loughead et al., 2006). To date, the majority of research examining athlete leadership has focused on large interdependent team sports such as volleyball, basketball, and soccer (e.g., Loughead & Hardy, 2005, 1985; Price &Weiss, 2011). In addition, research has shown that the dyadic relationship is critical in the coach-athlete relationship (Jowett & Cockerill, 2002). Consequently, little research has examined the athlete leadership behaviors in dyadic teams. Therefore, the purpose of this study was to examine athlete leadership behaviors in the dyadic sport of ice dancing. Semi-structured individual interviews were conducted with three senior competitive ice dance teams ($N = 6$ ice dancers). Dyads were interviewed separately with each interview lasting between 45 min to an hour. Avolio's (1999) full range leadership theory, which suggests that effective leadership is displayed using both transformational and transactional leadership styles was used as a framework for interpreting the data. Overall, the findings highlighted common athlete leadership behaviors in ice dance pairs, representing both transformational and transactional leadership styles. Specifically, the athlete leadership behaviors that emerged from the interviews were instructing each other in the techniques and tactics of the sport, being an effective role model, ensuring standards are met, staying focused on common goals, approaching old problems with new perspectives, and recognizing the importance of joint decision making. Findings from the present study provide evidence that the leadership behaviors between athletes in the dyadic sport of ice dancing can be considered within a full range view of leadership.

Social support from overweight parents: Does it relate to physical activity in children?

Pinsonnault Bilodeau, Gina; Sabiston, Catherine M.; McGill University; Brunet, Jennifer, University of Montreal

Parents may provide a variety of types of social support for their child's participation in physical activity (PA). This cross-sectional study explored the association between children's perceptions of social support for PA provided by their parents and their PA. Specific objectives were to (i) examine links between social support and moderate-to-vigorous PA (MVPA); and (ii) compare levels of social support across sources (mother, father) and types (tangible, intangible) in normal weight and overweight girls and boys. Baseline data from an ongoing cohort study (Quebec Adipose and Life Investigation in Youth) of 564 children (mean age = 9.6, SD = -0.9) were analyzed. Child's perception of social support from parents was measured in self-report questionnaires, and PA was assessed using accelerometers. In general, higher levels of intangible than tangible support were reported [$p <$ .05]. Overweight boys reported more intangible social support from mothers than normal weight boys [$p < .01$]. Regardless of weight status, boys reported more tangible support from fathers than from mothers. Overweight boys and normal weight girls reported more intangible support from mothers than from fathers. Tangible social support from mothers and fathers was positively related to MVPA in normal weight girls only [$p < .01$]. Results highlight the importance of tangible parental support in increasing MVPA for girls and suggest encouraging parents to increase the amount of time they spend engaging in and/or facilitating PA with their daughters might be beneficial. However, for other groups of children 8-10 years, child-centered perspectives might be better suited to promote MVPA since parental support was not significantly related to children's MVPA behavior. Future research is important to understanding whether the overweight parents (as in this study) create a home environment that is not conducive to PA compared to healthy-weight parents, which may thus downplay to positive effects of social support for PA.

Inspirational coaches: An underdeveloped phenomenon in sport psychology

Poynor, Rosemary; Arthur, Calum A.; Bangor University; Gibas, David, Université Paris-Sud

The sporting arena is replete of examples of great inspirational coaches that have led their teams to success. Indeed the role of the coach in developing and motivating athletes has been the focus of much research in sport psychology (e.g., Chelladurai & Saleh, 1980; Smoll, Smith, Barnett, & Everett, 1993). However, the sport psychology literature has tended to ignore the inspirational effects that great coaches can have on their teams. The current study aimed to provide an insight into inspiration in elite soccer coaching. A qualitative inquiry into managers' accounts of their endeavors to inspire their athletes' was undertaken. Five male elite soccer managers (3 UK premier league experience; 2 International experience) took part in one-to-one recorded interviews which were subsequently transcribed verbatim and analyzed using inductive content analysis (Creswell, 2002). Seven themes of inspirational behaviors emerged (vision, communicating the vision, charisma, need for change, follower empowerment, risk taking and leader reliability). The emergent themes found within this study support previous suggestions within organizational psychology literature (Bass, 1990, Conger & Kanungo, 1988, Griffin et al., 2010) with the exception of leader reliability behaviors (e.g., providing protection, pressure relief) which has not previously been discussed. The findings within this study have implications for the conceptualization of inspirational behaviors, their measurement and their application to sports coaching and management.

Effects of soccer ball "heading" frequency and intensity on scent identification and olfactory functioning

Raudenbush, Bryan; Capiola, August A.; Wheeling Jesuit University

Head injuries are of specific concern since the symptomatology associated with a blow to the head can include cognitive deficits ranging from mild memory impairment to dementia or even death (Cantu, 1996; Smodlaka, 1981). Olfactory impairment (anosmia) following traumatic brain injury range from 4% to 33%, with improper head-to-ball and head-to-head contact responsible for many of the reported soccer-related head injuries between 1960 and 1980 (Fields, 1989). The present study assessed scent identification and olfactory ability in collegiate soccer players, who are often at risk for traumatic head injury due to "heading" of the soccer ball. Participants were Division II intercollegiate men's and women's soccer players. Participants completed the Brief Smell Identification Test (BSIT) and the Provista Scent Memory Test (PSMT). The BSIT is a screening test for detecting smell loss via a "scratch and sniff" presentation. The PSMT employs a similar "scratch and sniff" presentation, and is currently the only FDA-cleared "smell test." Soccer athletes completed the scent identification tests twice, once pre-season and once post-season. During the post-season assessment they also completed a questionnaire regarding soccer "heading." For athletes showing a decrease in scent ability pre-post season, the correlations for degree of scent identification loss and various actions are as follow: heading frequency, $r = .75$; heading intensity, $r = .47$; number of past concussions, $r = .80$; average dizziness level following "heading," $r = .58$. The data were subjected to a multiple regression analysis and it was found that the variables of heading frequency, heading intensity, concussion, and dizziness accounted for 75% of the decreased ability to identify scents and olfactory functioning. Thus, a significant proportion of variance in decreased scent identification ability and olfactory functioning in these athletes is accounted for by behaviors related to soccer ball heading. These data indicate the need for education and intervention related to safer heading techniques.

Learning to hit in volleyball with verbal and visually enhanced feedback

Rhoads, Michael, University of Northern Colorado

Coaches continually seek more effective methods to improve instruction and facilitate learning. They may demonstrate desired movements, offer more or fewer comments, or emphasize athletes' successes or failures. Many coaches are particularly thoughtful about the format of feedback they provide. One method of instruction that has received a great deal of interest is visual feedback. Although the majority of researchers who have studied the topic believe visual feedback to be a viable method, studies looking at the effectiveness of this kind of feedback for teaching motor skills have shown mixed results (Rothstein, & Arnold, 1976; Rhoads, 2010). The current study sought to further examine the effectiveness of verbal and visual feedback for teaching hitting in volleyball. Participants took part in an experimental cross-over design where they learned through two types of instruction. In one type of instruction, participants received traditional coaching via verbal feedback. In the other instructional model, participants received both verbal and visual feedback (visually enhanced feedback). Participants received three acquisition sessions for each type of instruction. The order of instruction was randomly assigned so that half of the participants received one type of instruction first, while the other half of participants received the other type of instruction first. Testing sessions took place at the beginning of the experiment (pretest), in between instructional phases, and at the end of the experiment (posttest). Two outcome measures were assessed, including the height of contact when the participant hit the ball (measured using video footage in Dartfish) and the velocity of the ball produced by the hit (measured using a radar gun). A repeated-measures ANOVA was conducted to evaluate differences between verbal and visually enhanced feedback for the two outcome measures. No significant difference between the two types of instruction was found for either height of contact or velocity. Results of this study and implications for practitioners are discussed.

Pilot Study of a dog walking intervention: Effects of a focus on canine health

Rhodes, Ryan E.; Murray, Holly; Temple, Viviene A.; Tuokko, Holly A.; Wharf Higgins, Joan; University of Victoria

It has been suggested that the promotion of dog walking among owners who do not walk their dogs regularly may be a viable physical activity intervention aperture, yet research is very limited and no intervention studies have employed control groups. Therefore, the purpose of this pilot study was to examine the viability of dog walking for physical activity intervention using messages targeting canine health. Inactive dog owners (N = 58) were randomized to either a standard control condition or the intervention (persuasive material about canine health from walking and a calendar to mark walks) after completing a baseline questionnaire package and wearing a pedometer for one week. Fifty-one participants (standard condition n = 23; intervention condition n = 28) completed the six and 12 week follow-up questionnaire and pedometry packages. Intention to treat analyses using repeated measures analysis of variance showed that both groups significantly ($p <$ .01, χ^2 = .09 to .21) increased physical activity across the 12 weeks on both self-reported walking and pedometry. Specific follow-up analyses, however, identified that all time periods and all three outcome measures showed significant increases for the canine health message (χ^2 = .11 to .27), but pedometry and total walking did not significantly increase within the control group. The results for pedometry assessment also suggested a significant effect in the group × time condition (χ^2 = .04), but this was not identified in the self-report measures. The results are promising for the viability of increasing dog walking as a means

for physical activity promotion and suggest that theoretical fidelity targeting canine health may be a helpful approach.

Neighborhood aesthetics and its association with walking in a Canadian setting: A pilot study

Rhodes, Ryan E.; Dukic, Jelena; Temmel, Cara; University of Victoria

Understanding the environmental attributes of neighborhoods in relation to residents' physical activity behaviors has become a matter of increased interest amongst researchers. Recent studies have begun to validate audit tools for measuring the physical environment. The purpose of this pilot study was to: 1) evaluate the reliability of an audit instrument for measuring the aesthetic environment in Western Canada and 2) determine the relationship between aesthetics and actual walking among residents of two aesthetically different (high, low) neighborhoods. In the first part of the study, four independent observers used the aesthetic components of the Systematic Pedestrian and Cycling Environmental Scan (SPACES) to evaluate two neighborhoods based on their a priori aesthetic differences. Following this assessment, a systematic (door-to-door) sample of 66 residents in these neighborhoods completed a week of pedometry assessment and self-reported measures of walking, intention to walk, and their perception of the aesthetics of their neighborhood. The results of the first part of the study showed that SPACES possessed acceptable inter-and intra reliability across the four auditors and that the instrument showed large differences in the aesthetics of the two neighborhoods in the expected directions. Specifically, the proposed high aesthetic neighborhood showed significantly more aesthetic streetscape ($t = 9.39$; $p < 05$), views ($t = 42.43$; $p < 05$) and general aesthetics ($t = 6.00$; $p < 05$) than the proposed lower aesthetic environment. In the second part of the study, perceived aesthetics of the neighborhoods by residents was similar to the SPACES instrument, but there were no differences in pedometry, self-reported walking or intention to walk after controlling for the demographics of the two neighborhoods ($p > .30$). Overall, these results complement prior research and support the reliability and validity of SPACES, but raise questions about a reliable link between neighborhood aesthetics and walking.

The effect of joint behavior in groups of teammates and strangers

Rickers, Kate; Sullivan, Philip J.; Brock University

A recent discovery has implicated a chemical role in joint behavior. The synchrony effect (SE) refers to finding that individuals appear to release greater levels of endorphins when participating in a vigorous activity in synchrony with other compared to when they perform the same activity alone. Cohen et al., (2010) examined the 45-minute rowing performance of 12 elite athletes. Participants had significantly higher pain tolerance (interpreted as higher endorphin levels) after exercising with their teammates than after having the same work out alone. One characteristic of Cohen et al.'s study characterized a confounding factor with the synchrony condition; the participants were all members of the same rowing team. This is relevant, as social bonding has been linked to endorphin activity (Dunbar, 2010). This raises the possibility that the SE may have been due to performing with teammates as opposed to performing together. The current study was designed to examine if the SE may be influenced by the social presence of teammates. Twenty-four individuals (12 male, 12 female) rowed on ergometers for 45-min in both individual and group conditions. They ranged in age from 21-54 ($M = 24.65$, $SD = 8.51$). Half the participants rowed in the joint

action condition with teammates whereas the other half rowed with confederates. ANOVA analyses revealed pain tolerance was significantly higher after participating in group conditions compared to the individual condition, and that there was no significant difference between a group of strangers and teammates. Additionally, the SE did not differ between males or females.

Interactive effects of optimism and psychological skills on coping in training

Roberts, Ross, Bangor University; Hardy, Lew, Bangor University; Phillips, Lisa, University of Exeter; Johnstone, Jack, Bangor University

Dispositional optimism positively predicts coping with adversity (e.g., Carver et al., 2010). Thus, optimists would be expected to cope well with the demands of training, and less optimistic individuals (i.e., pessimists) would be expected to cope poorly. As such, an understanding of strategies that may aid pessimists' ability to cope would be worthwhile. In the psychological skills literature mastery imagery (MG-M imagery) and mastery self-talk (MMST) have been theorized to aid coping (e.g., Hardy et al., 2001; Martin et al., 1999) and so may be particularly beneficial for pessimists, but less so for optimists. To test this suggestion 166 participants (M_{age} = 17.98, SD = 19.26, n = 76 males) completed measures of optimism (LOT-R; Scheier et al., 1994), mastery imagery (MG-M imagery subscale from the SIQ; Hall et al., 1998), a measure of MMST, and a measure of coping in training (Woodman et al., 2010). Analyses were conducted separately for men and women. For males, moderated hierarchical regression analyses (MHR) revealed a non-significant interaction between MMST and optimism. However, the optimism × MGM-imagery interaction approached significance ($R^2\Delta$ = .04, p < .06). Counter to hypotheses, increases in imagery use were associated with increases in coping for optimists and not pessimists. For females, MHR revealed that only the interaction between MMST and optimism was significant ($R^2\Delta$ = .04, p < .05). The nature of the interaction was in line with the hypothesis; increases in MMST were associated with increases in coping for pessimists but not optimists. The results suggest that while MMST may aid female pessimists' ability to cope, imagery and self-talk do not seem to benefit male pessimists. These findings highlight the importance of considering both personality and psychological skills when trying to maximise training effectiveness, and contribute to the emerging literature (e.g., Woodman et al., 2010) demonstrating that some psychological skills are more effective for some people than others.

Component factors of decision-making ability in ball games

Sakuma, Haruo

The purpose of this study was to examine the difference in component factors of decision-making ability between experts and novices in ball games. These experiments consisted of 2 sessions and were investigated to find the difference of the type of athletics from the view of eye movements. There were two experiments. Experiment 1: Subjects were put on the goggle type eye movement device, displayed the three geometric configuration screens, given two buttons and measured eye movement and reaction time (RT) when searching targets. Experiment 2: Subjects were showed same screens Experiment 1. As a result, experts' visual field could be moved target distantly positioned from point of gaze and changed distribution and eye movement by the positions. The RT wasn't showed significant differences between experts and novices. The results of eye movement were great differences between experts who could make a prediction. The above results suggest that experts have a broad external

visual field and in the sports scene, which requires appropriate and efficient visual search. In addition, the difference between the experts is assumed to be due to sport specifics.

Augmenting cognitive performance through scent administration during Wii video game play

Sappington, Mark; McCombs, Kristin; Bova, Andrea; Raudenbush, Bryan; Wheeling Jesuit University

Past research has shown the positive effects of video game play, while other research has shown the performance enhancement benefits of peppermint scent administration. The present study assessed the combination of video game play and peppermint scent administration on physiology, mood, performance, and task load. Participants played 3 Nintendo Wii Fit Plus Games requiring cognitive and hand/eye reactions (Perfect 10, Snowball Fight, and Obstacle Course). Participants completed a baseline control condition and were then assigned to repeat the control session either with or without peppermint scent delivered via nasal cannula at 3LPM. Participants in the peppermint scent condition showed greater improvements, such as completing significantly more levels [$t(14) = -2.95$, $p = .01$], more hits [$t(14) = -4.03$, $p = .001$] and stars [$t(14) = -4.00$, $p = .012$], and distance completed [$t(14) = -1.97$, $p = .08$]. Further, participants in the peppermint condition reported decreased mental demand [$t(14) = 1.96$, $p = .070$], perceived effort [$t(14) = 2.27$, $p = .039$], and anxiety [$t(14) = 2.39$, $p = .031$]. In terms of physiological data, control group participants had a significantly lower pulse change [$t(15) = 2.246$, $p = .04$] and diastolic blood pressure change [$t(15) = 12.13$, $p = .069$]; whereas, participants in the peppermint scent condition experienced no significant difference in pulse, suggesting that the scent administration promoted greater physiological arousal, thus keeping participants more engaged in the testing process. Implications include the combination of video games and a physiologically arousing scent (specifically, peppermint) to further promote cognitive performance.

Exploring relational efficacy beliefs within youth coach-athlete relationships in developmental sports: The coaches' perspective

Saville, Paul D.; Bray, Steve; Graham, Jeffrey D.; Tran, Alexander; McMaster University

Self-efficacy (SE) has been shown to play a major role in motivating behaviors such as sport participation. Although people develop SE in large part through their own behavioral experiences and watching others perform, Lent and Lopez (2002) explain that interactions with influential others may also bolster SE by fostering relation-inferred self-efficacy (RISE) (e.g., an athlete's perception of her coach's beliefs in her abilities). In high performance sport, athletes' perceptions of coaches' and teammates' beliefs have been found to be associated with their own SE beliefs (Jackson et al., 2009). However, these perceptions have yet to be investigated in developmental sport. The purpose of this study was to explore coaches' perceptions of interactions that could influence their athletes' RISE beliefs. Five focus group interviews involving coaches ($N = 19$) from various youth sports were conducted. Thematic analyses of data from six discussion points were examined to identify prominent themes (Braun & Clarke, 2006). Results indicated that coaches use several interactions they believe enhance athletes' RISE beliefs. Verbal interactions were consolidated into five themes: encouragement, efficacy-building statements (e.g., I know you can do it), constructive feedback (e.g., widen your stance), non-outcome oriented statements (e.g., try your best), and relieving responsibility for failed attempts (e.g., that was unlucky). Non-verbal

interactions consisted of eight themes: elite opportunities (e.g., choosing them to take a penalty shot), strategic positioning (e.g., make sure . . . weaker players are among others that can help them), increased individual attention, position placement (e.g., [putting] them in strong positions), fostering personal relationships, equal sport involvement, expressiveness (e.g., always be smiley) and considering athletes' input. Findings are consistent with Lent and Lopez's conceptualization of interpersonal sources of SE and will be discussed in light of concurrent findings regarding athletes' perceptions of RISE-enhancing interactions.

Exploring relational efficacy beliefs within coach-athlete relationships in developmental youth sports: The athletes' perspective

Saville, Paul D.; Bray, Steve; Graham, Jeffrey D.; Tran, Alexander; McMaster University

Self-efficacy (SE) is a major motivator of behavior and may play an important role in youth sport participation. Although a great deal of literature focuses on the four major sources of SE (mastery, vicarious experience, social persuasion, affective/physiological states), the social environmental context that SE beliefs are developed in has seldom been examined. In high performance sports, athletes' perceptions of coaches' and teammates' beliefs and abilities have been found to be associated with their own SE beliefs (Jackson et al., 2007, 2009); however, developmental sports have not yet been investigated. The purpose of this study was to explore youth athletes' perceptions of relational efficacy and to identify interpersonal cues that manifest such beliefs within developmental sport programs. Five focus groups involving participants ($N = 28$; ages 8-12) from various sports were conducted. Focus groups consisted of discussion around 30 items and lasted approximately 60 min. Thematic analyses of data from seven discussion points were used to identify prominent themes that best explain the data (Braun & Clarke, 2006). Results indicated that youth athletes are cognizant of relational efficacy beliefs and interpret them based on several prominent interactions with their coach. Verbal interactions consisted of four distinct themes: general encouragement, efficacy-building statements (e.g., When the coach tells me he's confident in me), personalized instruction, and effort- focused statements (e.g., Who cares about the score as long as you try your hardest). Non-verbal interactions consisted of four distinct themes: elite opportunities (e.g., Pulling the goalie and putting you in), focused attention, sport involvement (e.g., Put you in longer and more frequently during games), and expressiveness (e.g., He pats you on the back). Overall, the data are consistent with Lent and Lopez's (2002) conceptualization of interpersonal sources of SE and findings will be interpreted in light of concurrent findings relating to coaches' perceptions of SE.

The motivational effects of social contagion on exercise participation in young female adults

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Individuals who are intrinsically motivated to participate in physical activity (PA) demonstrate greater adherence, effort, persistence of PA, and greater participation (Banting, Dimmock & Grove, 2011). Unfortunately, few individuals report intrinsic motivation for PA, and little known about modifiable correlates of one's motivation. This study investigated the associations between an individual's motivational climate (intrinsic or extrinsic motivation) and exercise outcomes (rating of perceived exertion (RPE), percentage of maximal heart rate (% maxHR) and total mood disturbance (TMD). Young inactive healthy weight females ($N = 42$; $\eta^2 = 21.59 \pm 3.31$ years; MBMI = 21.59 ± 2.11 kg/m^2) were randomly

assigned to either an intrinsic or extrinsic motivation group. The participants exercised on a treadmill beside a confederate who was providing them with intrinsic or extrinsic verbal cues, depending on the experimental group. During the exercise session, heart rate (HR) and RPE were measured every 2 min. Participants also completed a self-report questionnaire assessing TMD pre and post-exercise. When exercising with the confederate, %maxHR was significantly higher in the intrinsic motivation group ($M_{extrinsic}$ = 73.26 ± 11.74 % maxHR; $M_{intrinsic}$ = 80.57 ± 7.51 % maxHR; F (1, 41) = 5.79, p = 0.02). RPE and TMD was higher in the intrinsic motivation group (MRPE = 13.08 ± 1.42; MTMD = 23.50 ± 1.55) compared to the extrinsic motivation group (MRPE = 12.24 ± 1.68; MTMD = 23.45 ± 1.73) but did not reach statistical significance, F (1, 41) = 3.05, p = 0.09; F (1, 41) = 0.09, p = 0.93, respectively. The results of the study suggest that having an exercise partner who is providing intrinsically focused verbal cues may motivate an individual to exercise at a higher intensity.

Experiences of setbacks and excuse making by passionate exercisers and athletes

Schellenberg, Benjamin J. I.; Bailis, Daniel S.; Thacher, Tara M.; University of Manitoba

Despite the best of intentions, individuals often fail to engage in pre-planned physical activity. This study assessed the frequency of and excuse making for these lapses in individuals who were passionate for sport/exercise (Vallerand, 2010). University students (N = 208; female n = 123) completed questionnaires assessing the frequency of setbacks, whether they made up for these missed opportunities, and completed a measure assessing three types of excuses outlined by the triangle model of responsibility (Schlenker et al., 1994). Due to the ordinal nature of the setback data, a priori contrasts were conducted to examine linear relationships between types of passion and setback frequency. A linear relationship was found between setback frequency and harmonious passion (HP), but not obsessive passion (OP) – those who experienced less frequent incidences of setbacks reported higher levels of HP, $F(1, 198) = 4.50$, $p < .05$, partial $\eta^2 = .02$. Those who made up for these missed opportunities by engaging in the activity at a time when they would ordinarily do something else had higher levels of both HP and OP compared to individuals who did not make up for these lapses. Finally, hierarchical linear regression revealed that, after controlling for relative autonomy, HP was negatively associated with making excuses regarding obligation ("this was not my goal"; $\beta = -.22$, $p < .01$) and clarity ("the goal itself was unclear"; $\beta = -.25$, $p < .01$), while OP was positively associated with both these excuse types ($\beta = .18$, $p < .05$; and $\beta = .25$, $p < .01$, respectively). Excuse making may be a strategy adopted by individuals with high levels of OP to protect the self from experiences that conflict with important, and at times overwhelming, components of their self-concept. This study illustrated a profile of individuals with high levels of HP that involves infrequent missed activities and excuse making, while individuals with high levels of OP are likely to make excuses regarding goal obligation and clarity after failing to engage in their favorite activity.

Evaluation of a new talent identification program by the German Handball Federation

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The German Handball Federation conducts a talent identification program (TIP) with female (15-16 years) and male (16-17 years) youth handball players every year. In 2008, the DHB launched a modified TIP with anthropometric, motor, and psychological tests (Elferink-Gemser et al., 2005; Lidor et al., 2005; Mohamed et al., 2009) with the aim to improve

the predictive validity of the talent identification. This study evaluates the modified TIP in general and especially the predictive validity of the different tests. Youth handball players from 20 regional selection handball teams ($N = 542$, 259 female and 283 male, 14 to 16 years) performed a series of tests. The number of items for the following analyses was reduced to eight potential predictors by ratings. Nomination by the national coaches was the outcome variable. First, a multivariate analysis of variance with the factors nomination and gender was conducted. The results showed significant main effects for nomination (Wilks's $\lambda = .87$, $F[6, 169] = 4.39$, $p < .001$, $\eta^2 = .14$) and for gender (Wilks's $\lambda = .21$, $F[6, 169] = 101.37$, $p < .001$, $\eta^2 = .78$), but no interactions between both. Therefore stepwise discriminant analyses were carried out separately for each gender. For boys, 30-m sprint is mainly responsible for a large explained variance (55.9%). For girls, this is the 30-m sprint, ball throwing velocity, and achievement motivation (67.6%). The results indicate that singular tests differentiate between nominated and not-nominated female or male youth handball players (Mohamed et al., 2009) but the predictive validity is quite low. The predictors are just not sensitive and specific enough (Lidor et al., 2005). Therefore, TIP will be expanded by tactical tests (Elferink-Gemser et al., 2004) with open skills assuming that an increase of the predictive validity will occur. Additionally, a longitudinal study will be conducted to test long-term effects. Lidor R, Falk B, Arnon M, Cohen Y, Segal G, & Lnder Y. (2005). J Strength Cond Res, 19(2), 318-325. Elferink-Gemser MT, Visscher C, Lemmink KAPM, Mulder TW. (2004). J Sport Sci, 22, 1053-1063. Mohamed H, Vaeyens R, Matthys S, Multael M, Lefevre J, Lenoir M, Philippaerts R. (2009). J Sports Sci, 27, 257-266.

Motivational training for summer camp staff: Impact on youth self and task beliefs

Schroyer, Robin J.; Whaley, Diane E.; University of Virginia

Introducing the component of interest (Hidi & Renninger, 2006) to the expectancy-value model of Eccles (1983) and Ames' (1992) motivational climate, the purpose of this study was two-fold: (a) to understand the influence of a motivation-based staff training curriculum that fostered a task involving climate and focused on positive perceptions toward physical activity on adolescent perceptions of self and task beliefs, with an added component of interest; and (b) to examine the relationship between the motivational climate and adolescent task values, expectancies, and interest. Adult staff ($N = 15$) were provided a 2 hour motivational training program (intervention group) or behavioral management training program (control group). Adolescents in the program ($N = 68$; $M_{age} = 10.7$, $SD = .912$) were assessed at the beginning and end of the program (6 weeks) on expectancies, value, interest and perceived motivational climate. Results indicated that adolescents' perceptions of expectancies ($t(49) = 2.17$, $p < .05$) and value ($t(49) = 3.05$, $p < .01$) toward physical activity in the intervention group significantly improved with the motivational curriculum. Non-significant improvements were seen in both groups in perceptions of cost. Interest showed a marginal decline in the intervention group (M = .1, $SD = .75$, $t(49)$, = .948, $p = .348$). Additional analysis revealed 23% ($r^2 = .232$) of the variance in motivational climate was associated with expectancies, values, and interest. In general, adding a relatively brief motivational curriculum for staff was associated with increases in adolescent expectancies for success and value toward physical activity, and the perceived cost of participation was slightly decreased. In addition, there was a relationship between a mastery motivational climate and self and task beliefs. Discussion will focus on the need to investigate out of school programs as contexts for motivating adolescents to be more physically active, much like earlier research in physical education and sport contexts. Future research building on this project will also be discussed.

The relationship between imagery content and anxiety among athletic trainers

Seiler, Brian D.; Monsma, Eva V.; Perreault, Melanie E.; University of South Carolina

Athletic trainers (ATs) function in dynamic, high stakes environments similar to athletes and other healthcare professionals. Research on these populations has demonstrated that mental imagery is effective in reducing anxiety. Although preliminary evidence suggests that ATs use imagery for the same functions as athletes (Monsma et al., 2011), there is little research concerning imagery use and anxiety in this population. Therefore, the purpose of this study was to examine the relationship between imagery and anxiety among ATs. Participants ($n = 103$) from multiple collegiate tournament settings (basketball, football, soccer, baseball/softball, hockey) completed the Imagery Use by Athletic Trainers Questionnaire, a modified version of the Sport Imagery Questionnaire, and the Competitive State Anxiety Inventory-2 revised. All instrument subscales demonstrated adequate internal consistency (> .70). Results from stepwise multiple regression analysis revealed that cognitively anxious ATs were younger ($p < .05$), used more MG-A ($p < .01$), and used less MS ($p < .05$), while self-confident ATs used more MG-M ($p < .05$). Interestingly, only ATs working women's soccer were likely to view their cognitive and somatic anxiety as facilitating their performance ($p < .05$). Finally, somatic anxiety scores correctly classified the majority of ATs as having anxiety versus no anxiety prior to and during tournament games. Present findings are consistent with previous research (Vadocz, Hall, & Moritz, 1997; Monsma & Overby, 2004) in that ATs appear to follow a similar trend to athletes in their use of imagery content relative to cognitive anxiety and self-confidence. As a result, further inquiry into the effect of imagery content on the reduction of anxiety in this population is warranted. Additionally, investigation into physiological interventions may be worthwhile given that somatic anxiety appears to be a discriminating factor for AT anxiety prior to and during tournament games.

Mo-chi: Conceptualization of the so-called implicit contract in Chinese athletic teams from the perspectives of elite coaches

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Mo-chi ("implicit contract," translated literally into English) is a Chinese-language phrase frequently used by athletes and coaches from Chinese cultural to describe certain implicit common thoughts, feelings, and/or behaviors among members in sport teams. It is considered, by both athletes and coaches, one of the important deciding factors for team success. In spite of its importance, the exact meaning, nature, antecedents, and consequences of *mo-chi* have never been defined and studied systematically. The purpose of his study, as part of a series of studies pertaining to *mo-chi*, was to explore the nature of mo-chi by conceptualizing the core components of *mo-chi* and its potential antecedents from elite coaches' perspectives. Nine elite coaches (5 males, 4 females; aged 35 to 58; 9 to 32 years coaching experience) from Taiwanese national or international teams (rhythmic gymnast, basketball, baseball, volleyball, table-tennis, and badminton) were interviewed either individually or in a focus group. The data was analyzed inductively based on the grounded theory. We found three shared components in *mo-chi*, which were the accurate shared task knowledge, the accurate evaluation of each other's ability, and the accurate emotional awareness of each other. We also found four antecedents of *mo-chi*, including team member's characteristics, attitude, problem-resolving ability, and team climate. In general, according to elite coaches, *mo-chi* is a dynamic process in which group members trust each other and coordinate implicitly

based on the three shared components. Our findings suggested that *mo-chi* may be a concept combining concepts proposed in the literature including group cohesion, shared knowledge, group coordination, and beyond, in describing the dynamic processes of athletic groups.

The relationship between imagery speed and type in novice golfers

Shirazipour, Celina H.; Munroe-Chandler, Krista J.; Loughead, Todd M.; Vander Laan, Anthony G.; University of Windsor

The PETTLEP model provides practitioners with a set of guidelines when implementing imagery interventions and is grounded in the concept of functional equivalence or simulating the actual performance during imagery (Holmes & Collins, 2001). A central tenet of the model emphasizes the timing (speed) at which imagery is completed, suggesting real-time speed as most beneficial. However, research has demonstrated that athletes frequently change the speed of their imagery (Bernier & Fournier, 2010; Calmels & Fournier, 2001), and that different imagery speeds are associated with the use of different imagery types (Fournier, Deremaux, & Bernier, 2008; O & Hall, 2009). In addition, imagery speed changes as a function of the athlete's level of experience with a task (Beilock & Gonso, 2008). The purpose of the current study was to examine the relationship between imagery speed (slow-motion, real-time, and fast-motion) and imagery type in a golf putting task. Participants included 56 novice golfers (M_{age} = 21.50, SD = 1.89). Prior to every putt, they completed a practice swing and self-timed the speed of their imagery. After executing 10 putts in each of the three imagery speed conditions, participants completed the Sport Imagery Questionnaire (SIQ; Hall et al., 1998). The results of repeated-measures ANOVAs demonstrated that regardless of the imagery speed condition, cognitive imagery was used more often than motivational imagery (ps < .001). The results of this study further our understanding of novice golfers' use of imagery, and will assist practitioners in implementing imagery interventions.

Enhancing the predictive power of self-efficacy measures in research

Simons, Jeffery P., California State University East Bay

Self-efficacy is either central or of ancillary importance to empirical analyses in many psychological and motor behavior research studies. However, there is no single validated self-efficacy measure, so researchers need follow established guidelines to attempt reasonable validity for a particular theoretical purpose. Even if the measure is well-constructed, individual interpretation and scoring biases of participants can create considerable error variance in the data. In cases where relative variations in self-efficacy are most important, between-subjects methods can mask the latent predictive power of the measure, especially with small samples. Here, it is demonstrated that a within-subjects method can enhance the potential usefulness of self-efficacy measures in research. Evidence from two samples of study participants demonstrates how measures standardized to each individual can greatly increase the explained variance in a performance variable central to a separate research question. In the first example, a small sample (n = 8) of female collegiate basketball players rated their self-efficacy at a series of shot distances. Correlating raw self-efficacy data with experimental shot accuracy resulted in an R^2 = .04, ruling it out as a potential explanatory variable. Once standardized by individual responses, self-efficacy produced an explained variance of R^2 = .37 (p < .01), strong enough to contribute to the research analyses. In a second sample of collegiate baseball pitchers (n = 7), raw self-efficacy estimates failed to correlate with actual pitching accuracy measures at nine target distances (R^2 = .02). When

the measure was individually standardized, the predictive power improved massively (R^2 = .57, $p < .001$), demonstrating that efficacy expectations were indeed strongly related to actual ability, and again contributing to theoretical conclusions. The use of *z*-scores to transform without sacrificing integrity of data is discussed, and limitations to the method are addressed.

Examining the impact of transformational coaching behaviors and basic needs satisfaction on athlete training behaviors

Smith, Matt J., University of Chichester; Arthur, Calum, University of Wales, Bangor; Oliver, Emily, Aberystwyth University

Previous research has shown transformational leadership behaviors have a range of positive impacts in sport (e.g., Rowold, 2006; Callow, Smith, Hardy, Arthur, & Hardy, 2009). However, while researchers have examined the overall relationships between transformational behaviors and athlete outcomes, the present study aims to extend previous research by examining the influence of transformational leadership in a particular context. More specifically, we wished to explore whether the transformational behaviors of a coach would result in enhanced athlete outcomes in training. In addition, we aim extend previous work by examining whether basic needs satisfaction mediates the relationship between the transformational behaviors of a coach and athlete training behaviors. Participants were 406 university level athletes who completed the Differentiated Transformational Leadership Inventory (Callow, Smith, Hardy, Arthur, & Hardy, 2009) to assess their perceptions of their current coaches, who are the leaders of interest in the current study. Participants also completed the Basic Needs Satisfaction in Sport Scale (Ng, Lonsdale, & Hodge, 2010), and the Training Attitudes and Behaviors Questionnaire (Trait) (Oliver, & Markland, 2010). Structural equation modeling supported a model in which the two transformational behaviors of individual consideration and high performance expectations predicted coach psychological need satisfaction, which, in turn, positively predicted athlete training attitudes and behaviors. Direct positive effects of coaches' transformational behaviors on athlete training attitudes and behaviors were also found. Overall, the results highlight the importance of certain transformational behaviors that coaches exhibit, and athletes' psychological needs satisfaction, which in turn assists our understanding of the processes that facilitate positive attitudes and behaviors of athletes in the training environment.

"I" versus "We": Effects of different references of self-talk on performance anxiety

Son, Veronica; Oregon, Evelyn M.; Feltz, Deborah L.; Michigan State University

The purpose of this study was to examine how modifying the referent of self-talk statements with respect to level of agency (i.e., individual versus group) may influence team members' self-confidence and pre-competition anxiety within a team-based novel dart-throwing task. In addition, this investigation sought to explore the way in which one's relative performance within the team (i.e., superior performer versus inferior performer) may influence the effect of self-talk on pre-competition anxiety. Undergraduate participants (N = 60) were randomly assigned to one of two self-talk conditions, specifically (a) self-talk statements that focused upon one's personal capabilities or (b) self-talk statements emphasizing the group's capabilities. Then, teams were randomly created within each experimental condition and each member of the team made 10 practice throws after which the experimenter announced team and individual scores. Prior to performing in a team-based dart-throwing competition, participants in all conditions subsequently engaged in their assigned self-talk

and then rated their self-confidence and level of pre-competition anxiety on the Competitive State Anxiety Inventory-2R (CSAI-2R). Results showed that inferior team members reported lower pre-competition anxiety when individual-oriented self-talk was used, compared to when group-oriented self-talk was used. For best performers within a team, however, pre-competition anxiety was lower when they used group-oriented self-talk than when individual-oriented self-talk was implemented. Regarding self-confidence, no significant effect of self-talk was found. Findings are considered with respect to their novel theoretical contribution to anxiety literature in a group setting and their practical implications for decreasing pre-competition anxiety.

Differences in exercise identity rates in Hispanic females at the end of a dimension of wellness class

Soukup, Gregory J., University of the Incarnate Word

The CDC and ACSM recommend Americans accumulate 30 min of moderate-vigorous physical activity at least five days each week. Regular moderate-vigorous physical activity significantly improves health (USDHHS, 2008). Hispanic females in the U.S. have significantly higher rates of obesity, heart disease, diabetes, and cancer than White and Asian females (CDC, 2004; Ogden et al. 2006; USDHHS, 2000). The Office of Minority Health (USDHHS, 2011) reported 57.1% of Hispanic women were sedentary. Role identities give meaning and importance to individual behavior and researchers have reported that higher exercise identity is positively related to higher rates of physical activity (Anderson, Cychosz, & Charles, 1998; Anderson, Cychosz, & Franke, 2001; Cardinal & Cardinal, 1997; Soukup, Kellow, Gaus, Gray & Lantero, 2006). The University of the Incarnate Word requires a Dimension of Wellness class for all undergraduate students. A major class objective is to improve student attitudes towards exercise and regular lifelong physical activity. This study wanted to determine if the wellness curriculum produced a significant improvement in exercise identities of female Hispanic students. Data were collected from 41 students that ranged from 18 to 28 with an average age of 20. The Exercise Identity Scale (Anderson & Cychosz, 1994) was used to estimate rates of exercise identity. Scores range from 9 to 63, with higher scores indicating greater rates of exercise identity. Pre/Post scores were collected three months apart. A *t* test was used to determine differences in exercise identity with level of significance $p < .05$. The Pre-Test mean was 33.41 and Post-Test was 37.68. EIS scores improved 4.27 points (12.8%). The improvement in exercise identity was significant at the .000 level. This study suggests a three-month university wellness class significantly improved exercise identity levels of female Hispanic students and wellness curriculums could help improve exercise attitudes and promote physical activity and healthier lifestyles in Hispanic females.

Placing the blame on age: Adults' age attributions for physical activity failure as a function of physical activity status and age

Sparks, Cassandra R.; Young, Bradley W.; University of Ottawa

Age attributions may importantly influence how adults engage in physical activity (PA) (Courneya & McAuley, 1996; Sarkisian, Prohaska, Davis & Weiner, 2007). This study explored dispositional and situational age attributions and whether more or less active adults differentially attribute to age in relation to PA failure. 177 Canadian adults (M = 60.1 years; range = 45-74) responded to 9 survey items asking them to judge causal expla-

nations (Weiner, 1985) for the effects of aging. Exploratory factor analyses determined a 1-factor solution (73.4 % variance; $\alpha = .60$) entitled "General Attributions Towards Age" (GATA), which explained the degree to which adults dispositionally saw effects as being variable and personally controllable. Next, participants completed a PA survey (GLTEQ; Godin & Shephard, 1985) and a survey wherein they judged the strength of age as a cause for failure (e.g., Lachman & McArthur, 1986) in hypothetical PA situations. Median splits divided the GLTEQ and GATA data. 2 GLTEQ (active, less active) by 2 GATA (optimistic, pessimistic) ANOVAs were conducted with strength of situational age attribution as the dependent variable, for each of four situations, and age groups (45-54; 55-64). Across age groups, there were significant interactions (all Fs > 3.5) whereby less active adults who also had pessimistic GATA dispositions most strongly blamed age for failure at a gym, $p < .05$, in community recreation programs, $p = .06$, and in unstructured/spontaneous situations, $p < .05$. Less active 45-54 year-olds who also had pessimistic GATA dispositions most strongly blamed age in unstructured settings, $F = 6.4$, $p < .02$. Less active 55-64 year-olds who also had pessimistic GATA dispositions most strongly blamed age for not achieving recommended PA guidelines, $F = 11.6$, $p < .001$. We discuss how pessimistic dispositional aging attributions may interact with situationally specific age blame to create PA barriers. We address how attribution retraining to view aging effects more optimistically (as variable, context-dependent, controllable) may help address age barriers.

A comparative study of the determinants of physical activity among Korean children in Korea and Canada

Spence, John C.; Lee, Jong-Gil; University of Alberta

Background & Purpose: Though reduced physical activity levels and increased sedentary behaviors have influenced the current epidemic of overweight and obesity in children, little attention has focused on youth physical activity among Asian populations. The purpose of this study was to examine determinants of PA among Korean children living in Canada and Korea using the Youth Physical Activity Promotion model (YPAP). According to YPAP, predisposing (perceived ability, perceived worth of the activity), enabling, and reinforcing factors help a child to be physically active and maintain an active lifestyle into adulthood. Methods: Using a convenience sampling strategy, 468 Korean Canadian (Kor-Can; mean age = 12.6 years) children were recruited from Korean language schools and churches in Edmonton, Calgary, and Vancouver and 626 Korean (Kor; mean age = 13.3 years) children were recruited from elementary and junior high schools in Seoul and Kyounggi-Do in Korea. Along with a questionnaire on the YPAP and demographic information, the children completed the Physical Activity Questionnaire for Children (PAQ-C). All written materials were translated in to Korean using a rigorous process. Results: Through a series of path analyses, significant direct or indirect relationships were found between all constructs from the YPAP and physical activity in both Kor and Kor-Can children. The main difference between the two groups was that Reinforcing factors directly affected PA in Kor children but worked indirectly through the two Predisposing (perceived ability & worth) factors for Kor-Can children. Also, Kor-Can children reported higher levels of perceived ability ($p = .001$) and enabling factors ($p = .001$) than Kor children. Conclusions: Though cultural factors are important determinants of PA among Korean children, the extent such factors influence behavior may be moderated by more dominant aspects of the social and physical environments in which these children reside.

Wheeling versus winning: Comparing demographic and social cognitive variables between sport participants and non-participants living with spinal cord injury

Stapleton, Jessie N.; Martin Ginis, Kathleen A.; McMaster University; Perrier, Marie J., Queen's University; Arbour-Nicitopoulos, Kelly P.; McMaster University

Leisure time physical activity (LTPA) has been shown to increase fitness among persons with spinal cord injury (SCI). However, only 50% of people with SCI engage in LTPA, and merely 8% are estimated to participate in sport for LTPA (Martin Ginis et al., 2010). The purpose of this study was to identify demographic and social cognitive correlates of LTPA that distinguish individuals with SCI who participate in sport ($n = 39$) from those who participate in exercise ($n = 242$). A hierarchical logistic regression was conducted to predict sport participation where demographic variables (age, sex, injury severity) were entered first (Block 1), followed by theory of planned behavior (TPB) variables (attitudes, intentions, norms, and perceived behavioral control; Block 2) that have been previously identified as correlates of LTPA. To adjust for the unequal sample size, a secondary hierarchical logistic analysis was conducted matching sport participants' ($n = 39$) demographic variables to an equal exercise participant sample ($n = 39$). For the primary analysis, the full model was significant ($\chi^2 = 26.74$, $p < .01$, Nagelkerke $R^2 = .16$). However, age was the only statistically significant predictor, OR = .94, indicating that as individuals with SCI age, their likelihood of sport participation decreases. For the secondary analysis, the full model was not statistically significant, and the effect of age diminished. These results indicate that TPB-related social cognitions do not distinguish sport participants from non-participants in active persons with SCI. Rather, other factors such as access to facilities and opportunities may be more influential. Additionally, these results suggest that younger people with SCI may be most likely to take advantage of sport opportunities. Given the potential value of sport for increasing overall LTPA, further research identifying barriers and facilitators to sport participation is integral to LTPA promotion strategies for this population.

When are head fakes most effective? An experimental study of the head fake effect in basketball

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Head orientation and gaze direction are sufficient social cues in reading the intentions of others, which is an important skill if one wants to be successful in a number of team sports such as basketball. A recent study (Kunde, Skirde, & Weigelt, 2011) showed that the gaze direction of basketball players is processed automatically and, if incongruent from the pass direction (head fake), cannot be ignored by the observer, which delays the recognition of future actions (e.g., a pass to the left). The present study examines the point in time at which basketball head fakes are most effective. In Experiment 1, participants watched short video clips in which two basketball players, displayed from a side view, performed different basketball passes. Each video clip was interrupted at one out of eight possible points in time before or after the pass (600, 480, 360, 240, and 120 ms before, at the beginning of the pass, or 120, 240 ms after the pass began). Participants had to decide if the right player was passing the ball with a bounce pass or chest pass, or reply with an uncertainty response ("I don't know"). The gaze direction of the player was either congruent (e.g., looking to the floor while performing a bounce pass), or incongruent (e.g., looking at the

other player's face while performing a bounce pass) to the pass direction. Results revealed a head fake effect, as participant's decisions were overall less accurate for incongruent gaze-pass-stimuli. The head fake effect was significant from 240 ms before until 240 ms after the passing action began, with the strongest effect (i.e., largest difference between congruent and incongruent gaze-pass directions) at the beginning of the pass. Experiment 2 demonstrated that the head fake effect is significantly reduced when the player's head is occluded, controlling for the effect of other bodily cues on action recognition. Therefore, varying the gaze direction is an effective way of deliberately misinforming others about one's own intentions in basketball.

On the left-handers' advantage in tennis: A matter of expertise!?

Strauss, Bernd, University of Muenster; Loffing, Florian, University of Kassel; Hagemann, Norbert, University of Kassel

The relative rareness of left-handers (i.e., 10-13 %) in comparison to right-handers may provide them with a negatively frequency-dependent advantage in dual confrontations (Raymond, et al., 1996). Studies reporting a significant excess and superior performance of left-handers at the elite level of interactive sports such as fencing, cricket and tennis corroborate this view (Grouios, 2004). However, considering that expert performance increased during past decades (e.g., due to deliberate practice, higher intensity and quality of training; Ericsson, et al., 1993) it is an open question whether the overrepresentation of left-handers in individual professional sports like tennis persists over time. In a longitudinal study (study 1) we analyzed handedness distribution in players listed in men's computerized ATP top 500 year-end world rankings from 1973 to 2010. Differentiation of left-hander frequencies by year revealed a linear decline in top 10 performers, whereas in top 100 players an inverse U-shaped pattern was found with percentages being around normal population values today. Moreover, by fitting the percentages of left-handed players found in ranking intervals of 50 players (i.e., 1-50, 51-100, etc.) to logarithmic functions for each year-end ranking we found that playing left-handed initially was but no longer is associated with high achievement in elite tennis. However, we also analyzed handedness distribution in $N = 3793$ male and female left-handed amateur players registered in the German Westphalian Tennis Association for the summer season 2008 (study 2). Albeit the cross-sectional design limits conclusive interpretation, here a left-handers' performance advantage appears to still exist since left-hander frequencies logarithmically increased with higher performance levels in men and women. Overall, our findings strengthen the hypothesis that left-handers do not benefit from an innate superiority but may have a frequency-dependent advantage whose impact on sporting achievement is likely to be reduced with players' expertise.

Comparing perceptual-cognitive skill in soccer coaches versus soccer players

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In many sports, it is common for top coaching positions to be held by former players; however, despite the natural progression in many sports for skilled players to become high-level coaches, we have little understanding of how playing may develop useful skills for coaching. In this study we considered perceptual-cognitive skill across groups of high and low skilled players and coaches (cf. Allard, Deakin, Parker, & Rodgers, 1993). The "low-skilled players" ($n = 18$) included relatively inexperienced soccer players while the "high-skilled

players" (n = 18) included soccer players of varying performance levels. "Low-skilled coaches" (n = 17) consisted soccer coaches currently coaching at a low amateur level while the "high-skilled coaches" (n = 20) were currently coaching at a high level. All coaches had pre-experiences as players. A range of perceptual-cognitive variables was measured in an attempt to capture the diverse skills demonstrated to be related to expertise in sport and coaching including: change blindness, pattern recognition, pattern recall, decision making as well as a half-time speech to determine qualitative differences between instructional strategies between the groups. Generally, results highlighted similarities between coaches and players on some tasks and differences on others. For example, players (particularly low-skilled players) were different from coaches on measures of pattern recognition, decision-making (number of options generated) and elements of the half-time task (e.g., coaches used "criticism" more than players while players 'praised' more than coaches) but were similar on measures of quality of decision-making options. These results provide a useful first step to further work examining the contribution of years spent as an athlete to the development of coaching expertise.

Lifestyle factors as predictors of self-determined motivation and level of physical activity

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While research frequently considers the influence of social factors (e.g., autonomy-supportive behaviors) and basic need satisfaction on self-determined motivation (see Hagger & Chatzisarantis, 2007 for review), lifestyle factors, including food consumed, sleep patterns, and alcohol use, are rarely considered as predictors. However, many believe anecdotally that drinking too much alcohol, sleeping too little, or eating less nutritious foods leads to more controlling types of motivation for physical activity and possibly lower levels of physical activity. The current study was designed to examine the relationships among these lifestyle factors, self-determined motivation for physical activity, and level of physical activity. A sample of 933 undergraduate college students completed a questionnaire. Using tertile split, participants were categorized as low, moderate, or high on each of the lifestyle measures (e.g., eating breakfast, produce consumption, frequency and quantity of alcohol consumed, total sleep per week, timing of sleep, delay in bedtimes and wake times on weekends). Next, the relationships between lifestyle factors and basic need satisfaction, different types of motivation, and level of physical activity were examined using MANOVAs. Results revealed that students who ate breakfast most frequently scored higher on basic need satisfaction, more self-determined motivation, and level of physical activity than those who ate breakfast least frequently. Those students who slept latest in the day scored higher on amotivation and lower on identified and intrinsic motivation than those with earlier sleep schedules. Students who either slept the most hours in a week or who stayed up latest on weekends, but not both, scored high on autonomy, competence, and intrinsic motivation. Alcohol variables were not predictive of physical activity variables. While the effect sizes were not dramatic, these results suggest that modifying diet quality and sleep schedules may have a positive impact on students' self-determined motivation towards physical activity.

EEG coherence between successful and unsuccessful golf putting

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Education, Taiwan; Huang, Chung-Ju, Taipei Physical Education College, Taiwan; Hung, Tsung-Min, National Taiwan Normal University

EEG coherence is a measure of correlation on a specific frequency band between two electrode sites. Higher coherence indicates more communication/interference between two sites while lower coherence suggests autonomy of each region. Although researches have shown skilled shooters demonstrated lower coherence during the preparatory processes of skill implementation than their less skilled counterparts, whether findings based on a between subject design can be applied to a within subject design is worthy of further examination. As such, the study intended to further examine the relationship between EEG coherence and motor performance by an intraindividual comparison design. Twenty college student golfers (aged 21.27 ± 1.59 years) with 8.5 ± 2.6 years of training and competition experience in golf were recruited. Each participant performed 40 putts with a distance to the hole of at least 3.5 m, depending on the individualized successful performance of 50 %. EEG was recorded at Fz, F3, F4, C3, C4, T3, T4, O1, and O2. Coherence analysis was performed on sites between Fz and the rest for the frequencies of high alpha, low alpha, low beta, and theta. A 2 (performance) × 8 (site) × 3 (time window) repeated measure ANOVA were used. Results showed a performance × time interaction on theta coherence. Follow-up analysis showed that theta coherence was higher at t3 (1.5-1.0 s prior to putting) than t1 (0.5-0 s prior to putting) in successful putting. In addition, theta coherence at t3 was larger for successful than unsuccessful performance. As for the other frequency bands, successful performance was associated with higher coherence on these two bands. In general, the study found higher coherence between Fz and other association cortices on most frequency bands examined. The findings were in contrast with past studies. It appeared that more communication between motor planning and other cortices were beneficial to golf putting performance.

Effects of exercise modality on executive function: A study of the Wisconsin card sorting test

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Research has been focused on the effects of fitness on cognition for the past two decades. Current findings not only indicated a positive relation between fitness and cognition, but also found that people with higher fitness were more capable regarding executive functions, defined as higher-level cognitive functions. However, most studies have focused on the effects of aerobic exercise, which is categorized as closed- and continuous- skills with less cognitive demands. Therefore, the effects of complex exercises on cognitive and executive functions have not been explored. The purpose of this study was to examine the effects of exercise modalities with different complexity and cognitive demands on the Wisconsin Card Sorting Test (WCST). Thirty college students were recruited for the present study, including 10 martial arts athletes, 10 jogging athletes, and 10 non-athletes. The training experience of the two athlete groups was from 7 to 8.5 years. All participants were determined the aerobic fitness through a cardio-respiratory fitness assessment with Bruce treadmill protocol). The WCST, a neuropsychological test, was chosen to assess executive functions. This test contains indices of Number of Categories Completed, Perseverative Errors, Non- perseverative Errors, Percent Conceptual Level Responses, and Failure to Maintain Set. The results revealed that there were no significant differences between groups. The results implied that the effects of different exercise modalities on

executive functions were limited. The current study only examined the effects of closed-skill exercises on executive performance and therefore the results could not presume a magnitude of influence regarding other exercise modalities on executive functions, such as open-skill exercises. Future research is suggested to further explore the effects of exercise with other types of closed skill or open-skill modalities on cognition.

Development of a Role Satisfaction Questionnaire

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Research in sport has focused on understanding role perceptions as it has been posited that effective performance of roles is critical for group success (Carron & Eys, 2012). One role perception that is important for both individual and group success is role satisfaction. Role satisfaction is defined as "a pleasurable emotional state resulting from the perception of one's [role] as fulfilling or allowing the fulfillment of one's important [role] values" (Locke, 1976, p. 246). Essentially, role satisfaction reflects how content an individual feels about his/her role responsibilities. In sport, role satisfaction has been positively linked to other role elements (e.g., role efficacy, role clarity) as well as team cohesion (Bray, 1998). However, empirical examinations of role satisfaction have remained stagnant due in part to the lack of a psychometrically sound measurement tool. Thus, the purpose of the present study was to develop a questionnaire designed to specifically assess athletes' perceptions of their satisfaction with the various aspects of role involvement. The study progressed in three stages. Phase 1 involved an examination of the existing role literature as well as construction of the initial 35 items within 7 proposed dimensions, including satisfaction with the role as it pertains to (a) skill utilization, (b) team significance, (c) personal significance, (d) feedback, (e) autonomy, (f) recognition, and (g) the athletes' overall responsibilities. Phase 2 involved the refinement of the questionnaire through its examination by a panel of experts ($n = 5$) from sport and organizational domains, in addition to a cognitive interviewing process with intercollegiate athletes ($n = 10$). In Phase 3, the underlying factor structure of the questionnaire is examined through exploratory factor analysis (i.e., principal components analyses) of responses provided by intercollegiate team sport athletes. Overall, this work has established a preliminary tool for assessing role satisfaction and future research directions/applied implications will be discussed.

Health-Enhancing physical activity and well-being: Is it how often, how long, or how much effort that matters?

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Abstract: Objective: The primary objective of the present study was to examine the potential mediational role of basic psychological needs satisfaction in explaining the relationship between episodic health-enhancing physical activity (HEPA) and well-being. Method: Participants ($N = 203$) were a convenience sample of young adults who were asked to recall, through the Day Reconstruction Method, the HEPAs engaged in during the previous day. Participants were subsequently invited to rate the extent to which psychological needs were satisfied with regards to each 'episode' as well as the extent to which both hedonic well-being (HWB) and eudaimonic wellbeing (EWB) were experienced. Results: Multiple mediation analyses provided evidence to suggest that psychological needs satisfaction for competence, autonomy and relatedness acted as intermediary variables in the relationship

between HEPA and positive affect (point estimate = 0.2206; BCa CI = 0.1226-.3634). Multiple regression analyses demonstrated that effort put forth in HEPA activities, as opposed to frequency or duration of HEPA, uniquely predicted well-being (i.e., βs ranged from .26 to .52) depending on the marker of well-being. Conclusion: Findings partially supported the tenets of Basic Psychological Needs Theory (Deci & Ryan, 2002) within the episodic activities reported. This provides further support for findings by Lyubomirsky et al. (2005), and demonstrates the importance of effort in relation to well-being. In the future, researchers may wish to investigate the utility of a HEPA program that facilitates effortful engagement and fulfillment of basic psychological needs.

Perceptions of communal coping among elite female curlers

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Athletes frequently report stressors which are social in nature (e.g., Reeves, Nicholls, & McKenna, 2009), and athletes frequently report seeking social support as a coping strategy (Holt & Hoar, 2006). Lyons and colleagues noted that "the impact of communal coping is obvious in team sport" (1998, p. 592); however, coping has typically been examined from an individualistic perspective (Hobfoll, 1994). The current study conceptualizes coping from a communal perspective which considers athletes' stressors and coping as well as the social context and relationships which influence coping. Communal coping is a reciprocal social process whereby stressors are appraised and acted upon in the context of close relationships (Hobfoll, 1994; Lyons, Mickelson, Sullivan, & Coyne, 1998). Thus, the purpose of this exploratory study was to examine perceptions of communal coping among a team of elite female curlers. This longitudinal case study involved repeated interviews with four elite female curlers (ages 23-50) at three points over a competitive season (12 interviews total) as well as field observations during practices and competitions. Content analyses from the early and mid-season interviews produced the following themes: a) emotional self regulation, b) emotional regulation of others, c) self-censorship, d) prosocial/cooperative action, and e) conditions for communal coping. Beyond coping with their own stressors, athletes reported ways in which they helped teammates cope with stressors or attempted to alleviate stressors for teammates. Findings highlighted ways in which team members adjusted individual coping strategies while taking into consideration their social relationships with team members. Communal coping is discussed as a useful theoretical perspective for understanding coping and social processes among team members.

The relationship between sport-confidence and passion among track and field athletes in elementary school

Teng, Kuo-Kai; Su, Ting-Yi; Kong, Hsiao-Fang; Wang, Chun-Chih; Chang, Yu-Kai, National Taiwan Sport University

Sport-confidence is the belief in one's abilities or the level of confidence regarding the ability to succeed in sports. Previous studies have found that sport-confidence is impacted by the duration involved in training. Recently, research on positive psychology has suggested that passion might also account for why athletes devote themselves to long-periods of harsh training. The purpose of this study was to investigate the relationship between sport-confidence and passion in elementary school athletes. 256 athletes with durations of training within two years, and durations of daily training for 1.45 hours were recruited from track and field teams (mean age = 10.94 years; 125 female). The participants completed

demography, a written consent, and a Sources of Confidence Inventory for Athletes, and also The Passion Scale in Sport. An independent sample *t*-test and one-way ANOVA were computed for demographic differences influencing sport-confidence and passion. Pearson product- moment correlation coefficients were also computed. The results indicated that there were significant differences among age, gender, durations of training, and ranks in sport influencing sport-confidence. Regarding correlation, technical/emotional perception, physical preparation, coaching leadership, vicarious experience, and past experience, these are all moderately correlated (r = .43-.51) to harmonious passion, while self-presentation and social support are slightly correlated to harmonious passion (r = .32-.38). In addition, only coaching leadership is moderately associated to obsessive passion (r = .41), while the others had low associated to obsessive passion (r = .17-.35). In conclusion, although sport-confidence was positively correlated to both harmonious and obsessive passions, harmonious passion is shown to be more crucial. Current research provides suggestions regarding to how to increase harmonious passion in athletes and how to train and develop harmonious passion among coaches.

Psychometric properties of the Mindfulness Inventory for Sport with an elite athlete population

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The Mindfulness Inventory for Sport (MIS) was recently developed in order to measure athletes' (a) awareness of thoughts, emotions, and bodily sensations in the present-moment (i.e., meta-awareness), (b) non-judgmental attitude towards these internal events, and (c) ability to remain focused (Thienot et al., 2011). The aim of this study was to examine the structural properties of the MIS, as well as exploring criterion validity via associations with important sport-based variables. A total of 343 state-, national-, and international-level athletes (M_{age} = 23.14, SD = 5.87) were recruited from team- and individual-sports. Participants completed the 19-item MIS, and instruments assessing worry, concentration disruption, flow, and perfectionism. Structural equation modeling was used to explore the fit of a correlated three-factor measurement model, which included latent variables reflecting meta-awareness (8 indicators), non-judgmental attitude (6 indicators), and refocusing (5 indicators). Having deleted three items on the basis of modification indices, analyses revealed that the data were an acceptable fit to the specified model, χ^2 (343) = 209.32 p < .001, CFI = .90, IFI = .91, RMSEA = .058 (90% CI .047 - .068), SRMR = .062. The latent meta-awareness and refocusing variables correlated significantly (r = .44), but the remaining correlations between MIS subscales were non-significant. Internal consistency estimates were acceptable for meta-awareness (α = .70), non-judgmental attitude (α = .72), and refocusing subscales (α = .80). In terms of criterion validity, higher non-judgmental attitude and refocusing scores were associated with lower levels of worry and concentration disruption. Analyses also revealed that scores on the refocusing subscale were positively correlated with flow, and that greater meta-awareness was associated with lower perfectionism and higher flow scores. Future research that provides further validity evidence for the MIS is encouraged, with an emphasis on expanding the study of mindfulness in sporting contexts.

Effect of graphic modality of human model on anticipatory behavior in tennis

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Recent computer technology makes it possible to create human models of athletic movement using computer graphics (CG). Previous studies on anticipatory skills of tennis services revealed that expert tennis players show better performance than novice players because the experts could pick up the advance cues prior to the timing of racket-ball. In the present study, we manipulated the graphic modality of a tennis server model to investigate what kind of properties of the model is essential to anticipate the direction of a tennis service. The ratio of correct responses in anticipation of tennis services was measured with the following conditions: video model condition (VTR), polygon model condition (Polygon), and point-light model condition (Point). In the VTR condition, the video of a tennis service was presented, and participants were requested to anticipate the direction of the tennis service. In the Polygon condition, the polygon model of a tennis server was presented, and the point-light model of a tennis server was displayed in the Point condition. The model presentation was occluded immediately before the ball impact of a service, and the participants were requested to pressing a button anticipating the direction of the tennis service. Twenty-one subjects, 11 skilled tennis players and 10 novice players, participated the experiment. They performed totally 108 trials, and the correct ratios were subjected to a multivariate analysis of variance (MANOVA) with Group (skilled, novice), Condition (VTR, Polygon, Point), and Session (first session, second session) as factors. The MANOVA revealed that the correct ratio in the skilled tennis players were higher than novice players under the Point condition whereas there were no group differences in the VTR and Polygon conditions. The present findings suggest that tennis players could employ a strategy focusing on essential kinematic information to anticipate the direction of the tennis service whereas novice players would extract anticipatory cues from shapes or colors of tennis server models.

Changing minds, changing lives: A preliminary investigation of a national knowledge translation initiative to increase physical activity and parasport participation in Canada

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Since 2005, the Canadian Paralympic Committee's Changing Minds, Changing Lives (CMCL) seminar program has educated health care professionals (HCPs) across Canada about the importance of physical activity (PA) and parasport for persons with physical disabilities. CMCL's goal is to provide HCPs with resources and skills to promote PA and parasport to patients/clients. In 2011, the CMCL curriculum was modified to include theory- and evidence-based best practices for PA behavior change. It was then taught to CMCL provincial coordinators who are, in turn, responsible for training local staff to present the curriculum to HCPs. Using the RE-AIM framework (Glasgow et al., 1999), this pilot project served to identify potential barriers to adoption and implementation of the new curriculum. At 3 time points, 7 coordinators representing 8 Canadian provinces rated their attitudes, self-efficacy (SE), subjective norms, and intentions (INT) to deliver the new curriculum. Using mixed-methods, coordinators rated and commented on the new curriculum according to Diffusion of Innovation characteristics (Rogers, 1983). Paired samples *t* tests revealed significant increases in coordinators' SE ($M \pm SD$ pre = 5.860.56, $M \pm SD$ post = 6.64 ± 0.35, out of 7; $p = .025$) and attitudes ($M \pm SD$ pre = 5.95 ± 0.46, $M \pm SD$ post = 6.55 ± 0.23, out of 7; $p = .015$) towards the new curriculum after an initial curriculum training session. Coordinators also reported that the new curriculum was compatible with

their needs, minimally complex, and had an advantage over previous versions. However, one month later, there was a significant decrease in attitudes ($M \pm SD$ 1-mo = 5.93 ± 0.48, p = .017) and INT to use the new curriculum in its entirety ($M \pm SD$ post = 100.00 ± 0.00, $M \pm SD$ 1-mo = 93.57 ± 4.76, p = .012). These results suggest that interventionists' initial positive responses to an evidence-based, PA-promoting curriculum are not necessarily maintained once implementation begins. Interventionists may require ongoing coaching support to sustain their commitment and maximize the likelihood of full curriculum adoption and implementation.

Who's in motion? The reach and effectiveness of Get in Motion: A telephone-based leisure-time physical activity counseling service for Canadian adults with spinal cord injury

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People with spinal cord injury (SCI) want information on how to become more physically active. Consequently, Get in Motion (GIM), the first-ever national leisure-time physical activity (LTPA) telephone-counseling service for Canadians with SCI, was launched in June 2008. Using the RE-AIM framework (Glasgow et al., 1999), this study examined the reach (n = 65) and effectiveness (n = 53) of GIM clients who enrolled in the program between June 2008 and June 2011. Demographic information was collection upon enrollment. Telephone interviews were conducted with interested GIM clients (n = 53) at four time points (baseline, 2, 4, and 6 months) to assess changes in LTPA intentions and behavior, secondary health complications (SC), life satisfaction (LS), autonomy and participation, and self-efficacy for activities of daily living (ADL-SE). In terms of reach, age and years post injury ($M \pm SD$) of the clients were 50.4 ± 12.8 and 14.5 ± 12.7 years, respectively. Most clients had tetraplegia (52%), were male (58%), used a manual and/or power wheelchair (83%), completed post-secondary education (69%), were active at time of enrollment (54%), and were from Southern Ontario (59%). In terms of effectiveness, clients' LTPA intentions were high at baseline ($M \pm SD$ = 4.8 ± 2.0, out of 7), and did not significantly change over 6 months (ds = .04 to .31). Paired t tests revealed significant increases for LS between baseline and 4 months (d = .54; p = .002) and for ADL-SE between 2 and 4 months (d = .42; p = .019), as well as significant decreases in the number of SC reported between baseline and 2-months (d = -.34; p = .033). Effect sizes for LTPA behavior were small (ds = .04 to .20) and non-significant (ps > = .119); however, trends were in the expected direction. Analyses of reach data indicate that men are underrepresented in the GIM service (RHI Report, 2010). Overall, GIM appears to be effective at maintaining strong LTPA intentions and behavior, and other aspects of quality of life. Future directions for GIM include more rigorous recruitment methods and monitoring of the service's implementation.

Students' psychological processes observed in acquisition of life skills through physical education classes

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The purpose of this research is to validate the process of students' life skills acquisition in physical education classes during a school term while considering the individual skill level of each student, low, middle or high. During the second class period we introduced a blind walk program, which is considered to improve life skills acquisition. In the second class

we introduced the blind walk program which is considered to encourage acquisition of life skills. We also verified the development of life skills through physical education classes with variance analysis of three elements: group A (experimental / control) × group B (low / middle / high) × time (before / after). Furthermore, we verified how students' life skills developed throughout the whole program by studying both their own reviews immediately following the blind walk session and the reports they submitted afterwards. Prior skill levels were also considered. The results are indicated below. 1) The internal process of life skills acquisition through physical education classes is different for each initial life skill level. In the low-level and middle-level groups, internal conflict in overcoming students' preconceptions that they were bad at sports or at building personal relationships in the classes was seen. 2) The control group in the middle skill level classification did not show significant improvement on the "thinking" subscale but the experimental group showed significant improvement on every subscale. Triggered by the blind walk, they learned to reflect on themselves even in other sports. Developing objective viewpoints such as those they acquired is one of the elements of life skill acquisition.

Understanding groupness: Exploring the effects of perceived cohesion and similarity

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Perceiving a collection of exercisers as a group (i.e., groupness) has been positively associated with exercise adherence (Spink et al., 2010). Given the recency of the construct, little is known about what aspects of the group might relate to one perceiving the other exercisers as a group. Two group constructs that may be relevant in this regard are cohesion (Carron et al., 1998) and perceived similarity (Harrison et al., 1998). As cohesion captures whether members stay together to pursue shared goals or because others make them feel good, it is possible that these perceptions of cohesion might be associated with feeling "groupier" (Priebe et al., 2011). Or, it is also plausible that simply perceiving group members as alike (i.e., similarity) might be related to higher perceptions of groupness (Dunlop & Beauchamp, 2011). This study examined the relationship between groupness and these two variables. Based on past research (Dunlop & Beauchamp, 2011; Priebe et al., 2011), it was predicted that facets of cohesion (ATG-Task) and similarity (deep-level) would predict individuals who perceived "high groupness" and "low groupness" in structured exercise groups. Reflecting on self-identified exercise groups, participants ($N = 210$) completed measures of groupness (Spink et al., 2010), cohesion (modified GEQ; Carron & Spink, 1992), and similarity (Harrison et al., 1998). A tertile split was used to classify those who reported perceptions of high ($n = 68$) versus low ($n = 65$) groupness when reflecting on their exercise group. Logistic regression was performed with ATG-Task, surface, and deep-level similarity predicting whether individuals perceived high or low levels of groupness. Results revealed that the overall model was significant ($\chi^2 = 31.05$, $p < .001$, Nagelkerke $R^2 = 0.28$). As expected, those reporting higher groupness in their exercise groups also reported higher perceptions of ATG-Task ($p < .01$) and deep-level similarity ($p < .05$). While in need replication, these results indicate that groupness may be associated with group constructs such as cohesion and similarity.

Preliminary findings From the Hawaii longitudinal study of fitness

Vercruyssen, Max; Mah, Donna; Heak, Sreang; Hawaii Academy

Longitudinal research on physical fitness across the lifespan is virtually nonexistent. Very few fitness test batteries have been applied simultaneously to participants ranging in age from two to 99 years and then repeatedly reapplied over years of testing to permit analyses of the data cross-sectionally, cross-sequentially, and longitudinally. Hawaii Academy is the only school we know that tests all 1400 student and 60 employees twice annually as part of this research project. Since starting this research in 1999, over 14,000 individuals have been tested, some with over 15 repeat testings. The fitness tests were designed to allow as many participants across the age and abilities spectrum to be sampled without ceiling and floor effects. Some were specifically developed to permit transformations that would allow comparisons across age and sex (e.g., vertical jump distance as a percentage of standing height or reach height, vertical jump converted to horsepower as a function of height or body-mass index). The tests have been refined to profile individuals and their changes over time in relation to themselves, their cohorts, and transformed generic measures. Thirty tests were conducted from six categories: Anthropometry (5), Strength (8), Flexibility (9), Skill (3), Speed (1), and Power (4). The goals of preliminary analyses were to (1) develop a ranking of all participants overall and by specific cohorts, (2) establish percentile norms for all collectively and by cohort, (3) create reports to communicate the top individual rankings and group percentiles, (4) create individual report cards that show each individual's profile and change/progress made in fitness tracking based on their previous testing, their cohort, and overall, and (5) create a screening report for alerting program managers of individuals receiving unusually low or high test results.

Fear and confusion of skills in a world class trampoline gymnast

Vercruyssen, Max; Vercruyssen, Nani; Mah, Donna; Hawaii Academy

When performing high-flying aerial maneuvers, particularly double and triple somersaults with twisting initiated at different locations of each somersault, one is surprised by the execution of an alternative and non-intended skill, the resulting fright and then fear and aversion interrupts training and can be traumatic. Repetition of such incidents in world-level gymnasts can be career-ending, career-limiting, or a temporary inconvenience that everyone wishes would go away as quickly as possible. The problem is widespread in gymnastics, diving, and most human acrobatic activities but is also found in non-acrobatic endeavors, even sedentary tasks that are disrupted (e.g., writer's block). The purpose of this report is to review traditional approaches to this problem and then highlight development of the therapy which has been successful for a current high profile performer emphasizing the most important treatment procedures and rules/principles discovered. This is a case study of a three-time age group world champion female trampoline gymnast, winner of every US national championship title in her sport, who became severely limited during her transition from junior elite to the senior elite ranks (2007 to present). She has managed her disorder sufficiently to remain among the top in her national ranking for the past six years allowing her to represent her country in nearly every world competition, but battles daily the risk of repeat incidents and sudden performance disruption. Her story is interesting on both a personal and professional level. Presented are videos of her performing troubling skills in her youth and what she does today, a review of attempts made by others in managing such limitations, and reports of what she and her coaches have found to be beneficial in battling her demons to remain competitive. This report concludes with recommendations from the player and her coaches, therapists, trainers, and parents with the intent of giving attendees empathy for those afflicted, perspective on the problem, and ideas for solutions.

Exploring athletes' use of a feedforward self-modeling video in competition

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Feedforward self-modeling (FF-SM), the process of viewing an edited video of the self performing beyond one's current ability (Dowrick, 1999), has been shown to be an effective tool for enhancing athletes' competitive performance (Ste-Marie, Rymal, Vertes, and Martini, 2011). Research has yet to explore the choices athletes would make if provided a FF-SM video in competition. Consequently, at three provincial qualifying competitions, nine competitive trampolinists aged 9-16 were given a personalized FF-SM video of their competitive trampoline routine one hour prior to competing. The participants were provided the opportunity to control their video viewings at their leisure. They were asked to self-report the details of their viewings (i.e., frequency and timing) within a logbook. The findings revealed that 8 of the 9 participants chose to view their video at each of the competitions. On average, the trampolinists viewed their FF-SM videos 6.29 times per competition. In addition, 89% of the sample viewed their videos during the designated stretch time which occurred prior to their warm-up on the trampolines, approximately an hour before competing; 62.5% viewed their videos during their warm-up on the trampolines; 22.2% viewed their videos immediately before competing, and only 11.1% viewed their videos after competing. The findings suggest that, when given the option, athletes choose to use FF-SM videos within a competitive setting. Furthermore, it appears as though the trampolinists prefer leaving sufficient time between viewing their videos and competing. These results can be of value for future researchers who plan on implementing similar observation interventions within a competitive setting.

Would I come back? The role of groupness and cohesion in intention to return

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Cohesiveness of a group appears to be linked to one's intention to return to an activity group after it has disbanded (Estabrooks & Carron, 1999; Spink 1995, 1998). While cohesion has emerged, one wonders whether other group constructs might also be associated with one's intention to return to activity. One group construct that may be worth examining is groupness, given that perceiving fellow members as a group has been positively associated with individual activity behavior (Spink et al.,2010). The purpose of this study was two-fold: (1) extend previous cohesion-intention studies (e.g., Spink, 1998) by examining the relationship between intention to return to an activity group and the perceptions of both the cohesiveness and groupness of that group prior to disbanding (2) explore this relationship in both structured (sign up for) and unstructured activity settings (do not sign for) given the suggestion that social psychological variables may be setting specific (Spink et al., 2012). Participants from structured (N = 203) and unstructured (N = 179) activity settings completed an online questionnaire that assessed groupness (Spink et al., 2010), cohesion (modified GEQ; Carron & Spink, 1992), and intention to return (Spink & Odnokon, 2001) to a self-identified activity setting. Separate multiple regressions for each setting were used to evaluate whether task cohesion (ATG-T and GI-T) and groupness would predict intention to return to that group in the future. In the structured setting, cohesion (ATG-T; $\beta = .18$, $p = .03$) and groupness ($\beta = .21$, $p = .03$) were predictors of intent to return, explaining 6.5% of the variance. A similar result was found in the unstructured setting with both cohesion (ATG-T; $\beta = .28$, $p = .004$) and groupness ($\beta = .17$, $p = .05$) emerging and explaining 7.9%

of the variance. These findings replicate research finding a relationship between cohesion and intent and extend it to perceptions of groupness as a predictor of an individual's intention to return to activity in two different activity settings - structured and unstructured.

The mediating effects of self-efficacy on the relationship between social support and adolescents' physical activities

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Past researches indicate that social support and self-efficacy are the stronger predictors of physical activity participation (Hamilton & White, 2008; Peterson, Lowe, Peterson, Nothwehr, Janz, & Lobas, 2008). However, very few studies examine the interplay of self-efficacy, social support and physical activity participation. Thus, the purpose of this study was to investigate the prediction of social support and self-efficacy on adolescents' physical activities as well as the mediating effect of self-efficacy on the relationship between peer support and physical activity. Two hundred fifty junior high school students (males = 130; females = 120; M_{age} = 15.29, SD = ±0.57) completed International Physical Activity Questionnaire (IPAQ), Perceived Self-Efficacy in Physical Activity Participation Scale (Wu, Ronis, Pender, & Jwo, 2002) and Social Support in Physical Activity Questionnaire (Lu, Jwo, & Huang, 2002). Hierarchical regression analyses found social support accounted greater variance in adolescents' physical activity (R^2 = .20) than self-efficacy (R^2 = .07) in predicting physical activity; however, self-efficacy partially mediated the relationship between social support and physical activity. Consistent with previous studies, this study found both peer social support and self-efficacy are influential in adolescents' physical activities. However, it is suggested that self-efficacy plays a subtle role underlying adolescents' participation in physical activity.

Exploring the relationships between relative age, components of physical literacy and positive youth development

Wattie, Nick, York University; Cobley, Stephen, Leeds Metropolitan University; McKenna, Jim, Leeds Metropolitan University

Age grouping policies in youth sport and education systems use a selection date (e.g., December 31st) to facilitate grouping youths into cohorts. These policies create relative age differences, with age differences ranging 1 to 364 days. Generally, relatively older youth experience a variety of advantages over their relatively younger peers, including being more likely to be selected to school and competitive sports teams. Relative age has been identified as influencing youth development (Thompson et al., 2004), while physical literacy has been similarly conceptualized (Whitehead, 2001). However, the relationships between relative age, physical literacy and positive youth development have yet to be explored. This gave the purpose to the current study. This study was a secondary analysis of the Rugby and Athletics Development Programme (RADs) dataset (N = 2105; mean age 11.57 years, SD ±.30; 50.9% female) comprised of pupils from 17 schools, in the North of England. Logistic regressions revealed that older relative age was related to physical literacy proficiency (strength, jumping and running speed) in both boys (OR = 5.18, 95% CI = 2.87-9.35) and girls (OR = 3.81, 95% CI = 1.93-7.53). Structural equation modeling suggested only marginal support for a model where older relative age predicted physical literacy (β = .17), and that physical literacy scores predicted (β = .16) increased scores of positive youth development among boys. The same model was less predictive among girls, with older relative age predicting

increased physical literacy scores (β = .12) and physical literacy scores predicting (beta = .09) higher scores for positive youth development. Results suggest that while relative age may predict physical literacy in both boys and girls, it was only in boys that physical literacy influenced indicators of positive youth development. While research should confirm these findings, results may nonetheless have implications for the structure and evaluation of physical education classes, and for future relative age interventions.

Do sport participation and relative age moderate youths' perceptions of internal and external developmental assets?

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Age grouping policies in youth sport and education systems use specific selection dates to create youth cohorts. These policies create relative age differences, with an age difference range up to 364 days. Generally, relatively older youth experience a variety of advantages over their younger peers, including selection to sports teams and higher academic achievement. This suggests that relatively older youths may be experiencing and/or be exposed to, more developmental assets (Benson, 2003), i.e., the building blocks that enhance positive behavior, deflect negative behavior and promote positive youth development (PYD). While sport participation—in its own right—can be an asset for ensuring PYD (Fraser-Thomas et al., 2005), research has yet to explore the relationships between relative age, sport participation and developmental assets. This study is based on data from 206 school pupils in the North of England (mean age 11.70 years, *SD* ± 0.29; 48.1% females). Pupils completed the developmental assets profile questionnaire, which measured internal (commitment to learning, positive values, social competencies and positive identity) and external assets (support, empowerment, boundaries/expectations and constructive use of time). Logistic regressions for boys and girls revealed no relationship between relative age and likelihood of sport participation. However, both higher internal (Boys: OR = 1.20, 95% CI = 1.07-1.35; Girls: OR = 1.27, 95% CI = 1.11-1.45) and external assets (Boys: OR = 1.31, 95% CI = 1.14-1.50; Girls OR = 1.29, 95% CI = 1.11-1.50) scores were linked to more sport participation. Relative age was independent of all measures of developmental assets. Although requiring replication, these results suggest that positive developmental environments—pupils were sampled from a school with the highest possible government quality rating—may moderate disadvantages associated with relative age.

Do barriers impact participation in physical activity in Canadian Seniors?

Weir, Patricia L.; Carr, Kelly; Wiseman, Alexandra; Calhoun, Kelly; McNevin, Nancy H.; University of Windsor

The Seniors in Canada report card (2006) gave Canadian seniors a grade of C+ for participation in physical activity, with 62% of seniors being inactive. It was suggested that health problems were not the only reason for the inactivity, but that it has not been incorporated into daily life due to a lack of awareness of the benefits. Using data from the Canadian Communities Health Survey – Healthy Aging the purpose of the current study was to examine patterns of activity in Canadian seniors (65+ years) who do not identify a health condition, illness or injury as a barrier to participation in physical activity. An overall sample size of 2738 seniors was identified, and of these 88.4% participated in some form of physical

activity over the last 7 days, while 11.5% reported no participation. Of the seniors who did not participate, between 70-97.5% identified no traditional barriers to participation in terms of cost, transportation, location, availability, fear of injury, lack of skill etc.. The most frequent barriers were lack of time and lack of motivation. In contrast to earlier findings, these seniors were aware of the health benefits of participation as both groups identified that increasing their level of involvement in exercise and sports was the most important change they made to improve their health over the last year. For those who participated in the last week, 51% named this as their number one priority compared to 32% who did not participate. Overall, barriers are not the main factor influencing seniors' decision to participate in physical activity. Funded by SSHRC grant # 862-2010-0007 (PLW).

Effectiveness of a school-based physical fitness program on adolescents' psychosocial outcomes

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Structured physical activity programs have the potential to promote positive developmental outcomes among youth, including self-perceptions, social relationships, and character (Weiss & Wiese-Bjornstal, 2009). Titus Champions is a fitness program delivered in physical education classes over the school year. Champions is designed to improve coordination, strength, speed, agility, endurance, and balance, thereby promoting an active lifestyle and health benefits. The purpose of this study was to evaluate the effectiveness of the Champions program in improving self-perceptions (physical, behavioral, social) and life skills (initiative, relationships, emotional regulation, group processes) from baseline to mid-intervention (10 weeks). The sample included 334 grade 6-8 students in the Champions program (181 males, 153 females) and 698 grade 6-8 students in control middle schools (347 males, 351 females). Students completed six subscales of Harter's (1988) Self-Perception Profile for Adolescents and four subscales of the Youth Experiences Survey (Hansen et al., 2003) prior to initiating and after 10 weeks of the program. A $2 \times 2 \times 2$ (group $\times$ gender $\times$ time) repeated measures MANOVA revealed a significant group by time interaction for self-perceptions. Students in Champions significantly improved in perceived physical competence, physical appearance, and peer acceptance from pre- to mid-intervention. A group $\times$ gender $\times$ time repeated measures MANOVA showed a significant 3-way interaction for life skills. Girls in Champions scored lower on life skills than female control students at mid-intervention; boys in Champions scored lower than controls on emotional regulation and positive relationships at mid-intervention. Results show that the fitness-oriented nature of Champions has a positive impact on self-perceptions among youth at the 10-week mark, but is not making the same impact with promoting personal and interpersonal skills. Participation in the program over the entire school year may be necessary to demonstrate and sustain program impact.

Salud: Teaching healthy eating and physical activity skills to Latino families

Whaley, Diane E.; DeBoer, Mark; Boitnott, Amy; University of Virginia

The family unit has critical importance for achieving weight loss for children (e.g., Pearson et al., 2009). Eccles' (1983) expectancy-value model posits that children's behavioral choices are directly related to their expectancies for success and value associated with the activity, and parents can influence these perceptions directly (through modeling) and indirectly (through the messages they convey to children). This 6-month pilot intervention consisted

of a parent counseling program, a child nutrition education curriculum, a physical activity component ("QuickStart" tennis) for children, and a shared healthy meal. Meetings occurred once a month for 6 consecutive months on a Sunday evening. Thirteen families, including 16 parents or guardians and 17 children between the ages of 8-11 were assessed pre- and post on BMI, servings of vegetables and fruit per week, perceptions of physical activity and health eating expectancies (parents and children), modeling of healthy behaviors (parents), and value toward physical activity and healthy eating (children). Results indicated a slight decrease in BMI for parents and children ($p = .1$), although the small number of completers ($n = 9$) prohibits drawing any strong conclusions. No changes were seen in vegetable/fruit consumption, but parent's assessment of expectancies for sport and perceptions of modeling increased ($p = .1$). No changes were seen in children's beliefs. Findings indicate that a community-based intervention can result in changes in participant's beliefs and behaviors. Discussion will also focus on the lessons we learned with regard to doing community intervention work, as well as the implications for future intervention efforts.

Effects of social belonging on self-regulatory efficacy and intentions to exercise

Wilson, A. Justine; Sylvester, Benjamin D.; Beauchamp, Mark R.; University of British Columbia

It has been suggested that humans possess an innate need to form social bonds (i.e., a need to "belong") because of the associated survival and reproductive benefits (Baumeister & Leary, 1995). The purpose of this pilot study was to examine the extent to which the effects of social belonging (feeling rejected vs. accepted) on exercise intentions and self-regulatory efficacy (SRE) are affected, based on whether exercise is framed as indicative of social skills or health benefits. This study involved a pre-test post-test randomized groups design. Pre-test measures of exercise intentions and SRE were completed online by a sample of inactive university students ($n = 44$), before completing a personality test in the lab. Participants were subsequently given bogus feedback based on the results of their personality assessment, in which they were informed that they could either expect a future alone (FA) or a future belonging (FB). Next, participants read a prime that either highlighted the health benefits (HB) of exercise or suggested that regular exercise is indicative of social skills (SS). Participants then completed the same measures as at pre-test. As hypothesized, the results indicated that when compared to participants in the FA and HB condition, participants in the FA and SS condition reported higher intentions to exercise ($d = 0.70$) and higher exercise SRE ($d = 0.80$). In addition, and as hypothesized, participants in the FB and HB condition reported higher intentions to exercise ($d = 0.15$) and higher exercise SRE ($d = 0.43$) than those in the FB and SS condition. Findings are consistent with recent studies (e.g., De Wall et al., 2008) that have found that socially rejected individuals are motivated to behave in ways to improve their likelihood of being socially accepted, specifically in comparison to achieving other beneficial outcomes (i.e., health benefits). The findings are discussed in relation to belongingness being a substantive motivator for behavioral change.

Adolescents' perceptions of transformational teaching, affective responses, and concentration in physical education classes

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Drawing from the tenets of transformational leadership theory (Bass & Riggio, 2006), recent research has sought to examine the predictive effects of transformational teaching behaviors within educational contexts (cf. Beauchamp & Morton, 2011) in relation to adaptive functioning among adolescents. The purpose of the current study was to examine the extent to which adolescents' perceptions of their physical education teachers' transformational leadership behaviors are related to positive and negative affect among adolescents as well as their level of concentration within physical education classes. Two thousand nine hundred and seventy seven adolescents (M_{age} = 14.33, SD = 1.00) from 133 Grade 8-10 classes completed the Transformational Teaching Questionnaire (TTQ; Beauchamp et al., 2010) in relation to their respective physical education teachers' behaviors, and two months later were invited to complete measures of positive affect (PA), negative affect (NA), and concentration. Using multilevel structural equation modeling, the results provided evidence of good model-data fit with regard to the a priori multilevel model (χ^2 (24) = 211.77, $p <$ .001, CFI = .98, TLI = .96, RMSEA = .05, $SRMR_{within}$ = .05, $SRMR_{between}$ = .04). At the student level, adolescent perceptions of transformational teaching were related to improved concentration within classes, and this relationship was mediated via student PA and NA. At the class level, the relationships between class perceptions of transformational teaching and concentration were mediated by PA, but not NA. Taken together, the results of this study suggest that displays of transformational teaching are predictive of improved PA and lower NA among students, and these affective responses have a substantive effect in relation to within-class cognitions (i.e., concentration).

Parental social control in preschoolers: The relationship with social support and parent activity

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Parents influence their children's activity in many ways including two commonly examined types: social support and parent activity (Trost & Loprinzi, 2011). Both social support (Loprinzi & Trost, 2010) and parent activity (Taylor et al., 2009) have been related to activity in preschoolers. One type of influence not examined in preschoolers is social control (SC), which is a regulatory type of social influence used in response to an undesired behavior (Lewis & Butterfield, 2005). Recently, SC has been related to activity in adolescents (Wilson & Spink, 2010). Despite being conceptually different, relationships between the different types of influence have been reported. For example, parent activity has been related to intention to use SC (Wilson & Spink, in press), and social support and SC have been positively related after knee surgery (Fekete et al., 2006). Given little research examining SC use by parents of preschoolers, this pilot study examined how SC is related to more common types of social influence: social support and parent activity. Parents of children age 2-6 (N = 25) completed an online survey that assessed SC (Wilson & Spink, 2010), social support (Trost et al., 2003) and parent activity (Godin & Shepard, 1985). A separate multiple regression was performed for each form of SC (positive, collaborative and negative) with social support and parent activity as predictors. For positive SC, the overall model was significant (F = 16.5, $p <$ .001), with both social support ($p <$ .001) and parent activity (p = .002) emerging as predictors. Similar results were seen with collaborative SC (F = 7.1, p = .004), with both social support (p = .01) and parent activity (p = .008) being significant. Neither social support nor parent activity were related to negative SC (F = 0.58, p = .57). These findings suggest that different types of social influence are related to each other but appear to be distinct constructs. Of the different forms of SC, positive

SC appeared share the greatest variance with social support and parent activity, although replication of these results are needed.

Motivational processes in commercial weight-loss program users: Is there a "spill-over" effect on weight-control behaviors?

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Optimal weight management is theorized to rely on at least two health promoting behaviors, namely enhanced physical activity and reduced caloric intake (Mata et al., 2009). Additional studies indicate that autonomous motives regulate the health behaviors central to optimal weight-management (Teixeira & Mata, 2011). However, few studies have tested cross-domain (or "spill-over"; Mata et al., 2009) effects linking motivation in one context (e.g., physical activity) with weight-control behaviors in other context (e.g., healthy eating). Guided by Organismic Integration Theory (OIT; Deci & Ryan, 2002) and previous research (Mata et al., 2009), the purpose of this study was to address the tenability of "spill-over" effects in relation to weight management behaviors among commercial weight-loss program users. Participants ($N = 90$) completed assessments of motivation for healthy eating (Pelletier et al., 2004) and physical activity (Markland & Tobin, 2004) along with indices of habitual physical activity participation (Godin & Shephard, 1985) and typical fruit/vegetable consumption per day (Blanchard et al., 2007). Within-context sources of autonomous motivation displayed stronger correlations with weight-management behaviors (rs = .27 to .50, ps < .05) compared to controlled motivation (rs = -.18 to .06, all ps > .05). Simultaneous multiple regression analyses indicated that context-specific sources of autonomous motivation were the strongest and only predictor of habitual physical activity (R^2 adj. = 0.22; β = 0.50, $p < .05$) and daily fruit/vegetable intake (R^2 adj. = 0.09; $\beta = 0.27$, $p < .05$). Overall, the results of this preliminary study further substantiate the importance of autonomous (rather than controlled) motives for understanding health behaviors tied to weight-control yet offer limited support for spill-over effects linking motives in one context with health behaviors in another context. Supported by a grant from the Social Sciences and Humanities Research Council of Canada

Utility of the Goal Content in Exercise Questionnaire among commercial weight-loss program users: A within- and between-network validation study

Wilson, Philip M.; Mack, Diane E.; Brock University; Blanchard, Chris M., Dalhousie University; Meldrum, Lindsay S.; Grattan, Kimberly P.; Brock University

Goal Contents Theory has emerged as an important sub-component of motivational processes theorized to guide behavior and enhance well-being consistent with self-determination theory (Deci & Ryan, 2002). Based on advancements in the SDT literature, the Goal Content in Exercise Questionnaire (GCEQ; Sebire et al., 2008) has been recently developed to measure intrinsic (e.g., skill development) and extrinsic (e.g., image) goal contents inherent to exercise participation. This study sought to extend the evidence-base informing the utility of the GCEQ by examining select within- and between-network issues of construct validation in a sample of commercial weight-loss program users. Participants ($N = 137$) completed the GCEQ and the Behavioral Regulation in Exercise Questionnaire-2 (Markland & Tobin, 2004) during one test administration. Confirmatory Factor Analysis of the GCEQ scores provided mixed support for the tenability of a 5-factor, correlated

measurement model ($\chi^2 = 380.36$, $df = 160$, $p = < .01$, CFI/IFI = 0.88, RMSEA = 0.10 [95%CI = 0.09-0.11]). Moderate-to-strong standardized factor loadings were evident (MFL = 0.78; SDFL = 0.13; range = 0.47-0.96; all *p*s < .05), accompanied by a pattern of inter-factor correlations ranging from 0.25 to 0.61 (all *p*s < .05). Skill Development was not significantly correlated with Image in this sample ($r = 0.17$, $p = .08$). Estimates of internal consistency reliability (Cronbach, 1951) ranged from 0.71 to 0.89 (mean $\alpha = 0.84$) across GCEQ item scores. Controlled motives were more positively correlated with extrinsic ($r = .27$-$.42$) than intrinsic goals ($r = .10$-$.27$), while autonomous motives were more strongly correlated with intrinsic ($r = .29$-$.45$) than extrinsic goals ($r = -.06$-$.15$). Overall, these findings imply that the GCEQ may be a useful instrument for assessing goal contents associated with exercise participation in users of commercial weight-loss programs, although further investigation may be warranted. Supported by a grant from the Social Sciences and Humanities Research Council of Canada.

Asymmetrical brain activation in athletes predicts peak performance and flow

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One of the essential characteristics of skilled athletic performance is the ability to perform movements automatically and without distracting thoughts. This mental state of flow is thought to be related to asymmetrical brain activation, because the left hemisphere is associated with verbal-analytic and the right with visuo-spatial processes. Using tools like electroencephalography (EEG) it has been shown, that there is increased cortical activity in the right compared to the left hemisphere (positive asymmetry score) in highly skilled athletes prior to performing a sport specific movement (Hatfield, Haufler, Hung, & Spalding, 2004). However, there is no evidence for the activation asymmetry in high reactive sports. We tested the hypotheses that highly skilled table tennis players ($N = 14$) show a positive asymmetry score prior to the execution of a sport-specific movement whereas table tennis amateurs ($N = 14$) should show a negative asymmetry score. Further, the asymmetry score is expected to correlate positively with flow. Participants watched 40 standardized video clips (7 s) of an opponent performing a table tennis serve and were instructed to imagine reacting to the serve with a forehand top spin. The 4th second was the time for the subjects to start the imagined return. We recorded EEG and measured flow with a German scale. Results showed that the asymmetry score in experts changed from negative to positive (4th to 5th second) whereas for amateurs the score remained negative over time ($p < .05$, $\eta 2 = .185$). Further, the experts' asymmetry score (5th second) correlated positively with flow ($r\ (13) = .495$, $p < .05$). Our findings provide new evidence, that also highly skilled table tennis players show lower relative left hemispheric activation compared to amateurs shortly prior to an imagined sport-specific movement, and that this activation pattern is correlated with flow. Hatfield, B. D., Haufler, A. J., Hung, T.-M., & Spalding, T. W. (2004). Electroencephalographic studies of skilled psychomotor performance. Journal of Clinical Neurophysiology, 21(3), 144-156.

Team cohesion predicts athletes' precompetitive appraisals: Is this a link between cohesion and emotion?

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Higher team cohesion is related to more subdued and positively toned precompetitive emotional states of the individual athletes (Eys et al., 2003; Prapavessis & Carron, 1996). The need to consider variables mediating this link has also been suggested (Prapavessis & Carron, 1996). According to cognitive-motivational-relational theory (Lazarus, 1999), emotions are the result of individual cognitive appraisals. As such, the aim of the present study was to test if dimensions of perceived team cohesion predicted athletes' precompetitive primary (i.e., perceived importance of the situation) and secondary appraisals (i.e., perceived prospects for successful coping; Lazarus, 1999) and thus investigate if these have the potential to act as mediators between cohesion and emotions. Competitive College and University athletes (N = 384, M = 20.32 years; 51.3% female) from 27 teams (basketball, ice hockey, and volleyball) responded to the Group Environment Questionnaire (Carron et al., 1985) and a Precompetitive Appraisal Measure (Wolf et al., 2011) prior to a regular in-season game (M = 83 min). As required, dependence in the data due to team affiliation was managed using multilevel regression. For individual primary appraisals, individual perceptions of cohesion were significant predictors (R^2 = .10), with the dimensions of Individual Attractions to the Group-task (B = .21) and Group Integration-task (B = .20) explaining unique variance. For individual secondary appraisals, individual perceptions of cohesion were again significant predictors (R^2 = .17), with the dimensions Individual Attractions to the Group-social (B = .24) and Individual Attractions to the Group-task (B = .62) explaining unique variance. It is concluded that athletes' perceptions of cohesion are relevant to their precompetitive appraisals. However, the relationship between cohesion and precompetitive emotions may be more complex than previously assumed because high cohesion coincides with both a higher perceived situational importance and greater coping expectations.

Cortical activity during visuomotor performance in disabled and non-disabled elite shooter

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The purpose of the study is to investigate the difference in cortical activity during target shooting between elite shooters without and with spinal cord injury. Participants were twenty two non-disabled and twelve disabled national team in air-pistol shooting. They were completed twenty self-paced 10 m air pistol shots. Cortical activation at frontal, central, temporal region during 5-s aiming period was analyzed. The analysis revealed that the disabled exhibited cortical hyperactivation typically observed in patients with spinal cord injury during visuomotor performance, but brain regions which are responsible for visual-spatial processing seem to be recovered to a level of the non-disabled through constant and deliberate practice of visuomotor skill. The findings of the study are consistent with the notion of relative economy in the cortical processes in elite shooters and neural plasticity in individuals with spinal cord injury.

The associations between multi-dimensional self-efficacy and physical activity in patients with coronary heart disease

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Background: Patients with coronary heart disease (CHD) are recommended to engage in regular physical activity to improve health and lower the risk of recurrent cardiac events.

Nevertheless, about 40% of patients with CHD in Taiwan do not exercise regularly. Past experiences of heart attacks may lower individuals' confidence and willingness to engage in physical activity. Self-efficacy has been shown to be a strong predictor of physical activity. The association between self-efficacy and physical activity in patients with CHD was not studied extensively. The purpose of this study was to examine the associations between multi-dimensional self-efficacy and physical activity in patients with CHD. Methods: Patients with CHD were recruited for this study. Physical activity was assessed using the 7-day physical activity recall questionnaire. Duration and energy expenditure of total physical activity (TPA) and moderate to vigorous physical activity (MVPA) were used in data analysis. A multi-dimensional self-efficacy for exercise scale was used to assess participants' task, scheduling, and coping self-efficacy. Results: The results of the 84 participants (mean age 57.44 ± 10 years) showed that there was no significant correlation between energy expenditure and duration of TPA and self-efficacy. On the other hand, there was a significant positive correlation between scheduling efficacy and duration of MVPA ($r = 0.228$, $p = 0.038$). There was also a significant positive correlation between scheduling efficacy and energy expenditure of MVPA ($r = 0.279$, $p = 0.013$). Conclusions: The results of this study indicated that among the three subdomains of self-efficacy, only scheduling efficacy is significantly associated with level of physical activity in patients with CHD. It is suggested that a physical activity intervention program may target on enhancing one's scheduling self-efficacy to increase the likelihood of physical activity participation in this population.

Developing and validating instrument to assess psychosocial influences on physical activity among a national sample of Chinese urban youth: A mixed method

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Background: The purpose of the present study was two-fold: (1) to develop and validate a Chinese version of self-efficacy, social support, and outcome expectancy scales that would be used to measure psychosocial determinants of physical activity among urban Chinese adolescents (grades 6-8), using a national representative sample; (2) to examine the reliability and construct validity of the scales. Methods: The survey development and revision process involved qualitative approaches. After a thorough cross-culture instrument development and validation literature review, we followed a five-step protocol suggested by Geisinger: (1) systematic literature review, (2) translation and back translation, (3) expert review for content validity, (4) cognitive interview, and (5) pilot study and test-retest. Several measures of psychosocial determinants of physical activity, including perceived social support, self-efficacy, and outcome expectancy, were developed and translated from English into Chinese, using the translation-back-translation procedure. These translated measures were administered to a sample of middle school (grade 6-8) students between the ages of 12 and 16 in six urban districts in a large city in northern China. Results: A total of 4,947 students completed the survey. Principal components factor analysis yielded two meaning self-efficacy factors (barrier efficacy and support-seeking efficacy) and two outcome expectancy factors (positive outcome expectancy and negative outcome expectancy). A composite score of perceived social support was calculated. Internal consistencies and test-retest reliabilities were adequate for all three scales. Perceived social support, self-efficacy, and outcome expectancy scales were significantly correlated with self-report physical activity behaviors for the whole sample and across different genders ($p < .0001$), which provided

evidence of concurrent criterion-related validity. Conclusions: These preliminary results provide support for using the scales to measure psychosocial determinants of physical activity in urban Chinese adolescents.

Effects of exercise modality on cardiovascular fitness and working memory

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Working memory, an important concept in cognitive psychology, represents the ability to store and operate information temporarily. Research has discovered that fitness has positive effects on working memory; however, most studies have only focused on the effects of simple motor exercises and none of them have explored the effects of different modalities of complicated motor exercises on working memory. The purpose of this study was to investigate the effects of exercise modalities on fitness and working memory. The participants included thirty young college students. Ten of these participants had attained mastery in the martial arts, the other 10 were professional runners, and the remaining 10 were people who did not participant in exercise regularly. Cardiovascular fitness of the participants was assessed by the treadmill and working memory was examined by an Arithmetic subtest of the Wechsler Adult Intelligence Scale–Third Edition (WAIS–III). The results revealed that the running group had superior cardiovascular fitness compared to both the martial arts and control groups and that the martial arts group had better cardiovascular fitness than the control group. Regarding working memory, the martial arts and running groups had superior performance on the arithmetic test compared to the control group, whereas the martial arts group had better performance compared to the running group. In conclusion, our findings suggest that people with higher cardiovascular fitness have better performance in working memory. In addition, different modalities of close-skill exercises have different influences on working memory. It is therefore worthwhile to investigate further the effects of exercise modalities on other sub-components of cognition.

The relationship of psychological needs, motivation, and behavioral outcomes of different types on leisure activities

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Objectives: The purpose of this study was to clarify the relationship of psychological needs, motivation, and behavioral outcomes of different types on leisure activities. Method: There were 583 participants who usually engage in leisure activities. Four questionnaires were conducted to examine how the different factors influence the behavior of leisure activities. They are the Psychological Needs Satisfaction of Exercise, Behavioral Regulation in Exercise Questionnaire version 2 (BREQ-2), Leisure Time Exercise Questionnaire, and well-being questionnaires. The collected data were analyzed by one-way ANOVA, multiple regression analysis, and SEM. Results: The results demonstrated four important findings. Firstly, the brisk walkers had significantly lower competence compared to other groups, and the ballroom dancers had higher relatedness than the brisk walking group. The brisk walkers had significantly higher amotivation and external regulation, and significantly lower identified regulation and intrinsic regulation. Secondly, the competence, autonomy, and relatedness could positively predicted self-determination motivation, exercise behavior, life satisfaction and positive affect, while autonomy demonstrated a negative influence on

negative affect. Thirdly, the self-determination motivation could positively predict exercise behavior, life satisfaction and positive affect, and negative influence on negative affect. Moreover, it demonstrated a partial invariance with different types of leisure activities. Conclusion: The implications derived from the findings for engaging in leisure activities are not only to support the self-determination theory but also effectively to validate the framework of applying in the context of leisure. Based on the results, the study suggests that people should keep doing leisure exercises regularly in order to increase life satisfaction and positive affect and some suggestions were issued for the future studies.

The moderating effects of paternalistic leadership on relations of achievement goals and sportspersonship

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Past research indicated that athletes' achievement goals influence sportspersonship (Gano-Overway, Guivernau, Magyar, Waldron, & Ewing, 2005; Leymre, Roberts, & Ommundsen, 2002). Also, it is found coaches' behavior direct predicted athletes' sportspersonship (Kavussanu, Roberts, & Ntoumanis, 2002; Kassing & Barber, 2007). The present study adopted paternalistic approach (Cheng, Chou, Wu, Huang, & Farh, 2004; Farh & Cheng, 2000; Westwood & Chan, 1992) and examined how paternalistic leadership moderated the relationship between achievement goals and sportspersonship. Three hundred and sixty-two adolescent athletes (M_{age} = 16.44, SD = +0.87) completed the 2 × 2 Achievement Goals Scale (Elliot & McGregor, 2001), Paternalistic Leadership in Sport Questionnaire (Kao, 2001), and Multidimensional Sportspersonship Orientation Scale (Vallerand, Briere, Blanchard, & Provencher, 1997). Results indicated that both achievement goals and paternalistic leadership not only predicted sportspersonship but also paternalistic leadership (i.e., authoritarianism and morality leadership) moderated the relationship between mastery approach and sportspersonship. Specifically, low mastery approach athletes had lower sportspersonship than high mastery approach athletes when perceived low authoritarianism/morality leaderships. This study concluded that paternalistic leadership could be an alternative approach to examine coach-athlete relationship, and future study may examine how paternalistic leadership influences athletes' growth and psychological responses.

Examination of negative outcomes in elite masters sport: A Passion analysis

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Dualistic passion model proposes that distinct types of obsessive (OP) and harmonious passion (HP) are associated with sustained sport behavior (Vallerand et al., 2003; 2007). OP and HP lead to different psycho-social outcomes, behavioral striving, and levels of conflict outside a passion activity (Séguin-Lévesque et al., 2003), some of which are maladaptive. This study examined differential relationships that OP and HP have with negative outcomes among elite Masters athletes, a group of highly invested individuals who may exhibit rigid sport persistence resulting in familial/social conflict (Yates et al., 1992). 165 (111 m, 54 f; M_{age} = 53.4, SD = 11.3 years; M hours weekly involvement = 13.4) World Masters Athletic Championship participants completed surveys measuring passion criteria, HP, OP (Vallerand et al., 2003), levels of conflict (e.g., with spouse/work; forfeiting family time, other important things), negative emotions (e.g., guilt, irritability, loneliness), amotivation (Ryan & Deci, 2000), self-pressure, risky behavior (e.g., training through injury/illness), and

intentions to decrease involvement. Separate sets of path analyses determined sequences of associations between each passion type, with each negative outcome variable, with conflict as the mediating variable. Results showed that conflict played a mediating role between OP and negative emotions (β direct = .21; β indirect = .25), and between OP and amotivation (beta direct = .27; beta indirect = .15), *p*s < .001. OP was associated with self-pressure (β = .40) and risky behavior (β = .21), *p*s < .05, though relationships did not depend on conflict. HP was associated (β = -.24, *p* = .01) with intentions to decrease involvement, but did not relate to conflict, nor lead to negative outcomes. Discussion focuses on how OP accounts for maladaptive outcomes in Masters sport and how conflict appears to be a mediating factor. HP allows for greater flexibility and voluntary persistence. Findings support a model with two distinct passion states with different pathways relating to conflict, and different associations with outcomes.

College students' stereotype and recognition about male and female athletes: A quantitative investigation

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This investigation examined the beliefs of college students regarding specific stereotypes and recognition about male and female athletes on gender, level of exercise participation, and need for closure (NFC) among college students. A fixed alternative questionnaire about personality trait was administered to 109 (male = 54, female = 55) undergraduate students. Participants were guided to check on 5-Likert scales about how much 53 personality traits were agreed on each description of stereotypes toward male and female athletes. The level of NFC was measured by using a Need for Closure Scale (NFCS; Webster & Kruglanski, 1994) which included 42 questions of 6-Likert scale, and the result was divided into two groups, a high and a low group on average. The results of the study were as follows: First, college students commonly perceived properties that male and female athletes represented as competitive, confident, talented, industrious, loyal, resolute, and patient. Second, stereotypes and recognition about male and female athletes were differently marked by respondents on their gender and experience as an athlete. Third, college students also differently perceived stereotypes and recognition about athletes according to their athletic career, the amount of information about athletes, their gender and experience as an athlete. This result shows the similarity to previous studies (Brewer, 1986; Schopler & Insko, 1992) in which stereotypes were likely perceived as more positive by in-group members, whereas as more unfriendly by out-group members. As considering this result, it is necessary for following studies to include other variables such as gender role attitudes and a cognitive target, in order to understand what mechanisms college students differently perceive stereotypes according to their group characteristics.

The following abstracts were published in last year's supplement, but the authors failed to appear at the conference to present their work. Therefore, these abstracts should not be referenced.

Friday, Sport & Exercise Psychology Verbal Session 5:

Comparing levels of anti-fat bias between American and Mexican athletes and undergraduate physical education and exercise science students.

Miriam W. Wood, James Whitehead, Sandra Short, & Martin Short; University of North Dakota

Thursday, Poster Session 1:

Coach and peer predictors of need fulfillment and self-determined motivation in youth soccer.

Amanda J. Kraemer & Meghan H. McDonough, Purdue University

Anticipatory cue in tennis: A spatial occlusion approach using computer graphics.

Hirofumi Ida, Tokyo Medical and Dental University; Kazunobu Fukuhara, & Motonobu Ishii; Tokyo Institute of Technology

Changes in postural motion and heart rate responses in a golf putting competition.

Samuel J. Haag & Michael G. Wade, University of Minnesota–Twin Cities

Friday, Poster Session 2:

Stress and recovery in high performance soccer athletes in training.

Maick D. Viana, Universidade do Estado de Santa Catarina-UDESC; Whyllerton Mayron Cruz, Alexandro Andrade, Ricardo Brandt; Santa Catarina State University

Pattern of alterations in motor circuit resting state fcMRI in Parkinson's disease patients due to medication and forced exercise.

Jay L. Alberts, Erik B. Beall, Anneke M. Frankemolle, Anil K. Thota, Michael D. Phillips, Amanda L. Penko, & Mark J. Lowe, Cleveland Clinic

Comparative studies of activity profiles of surfers under "clean" and "messy" conditions.

Kent Takeishi, Yukimasa Ishibashi, Tomohisa Nagano, & Takaaki Kato, Keio University

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