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the two types of time-dependent consolidation processes that occur following training, those associated with sleep have attracted the most attention at the cost of consideration for processes that occur in the post-training wakeful period. Notably, a range of interventions have been shown to provide wakeful motor memory including exercise, cognitive task performance and mindfulness meditation for which several questions remain unaddressed. For example, it is not known whether wakeful consolidation interventions are unique or share common features in how they support memory consolidation. To gain some perspective on this issue, we reviewed wakeful interventions for motor memory consolidation. While a range of means have been proposed to explain consolidation from wakeful interventions including exercise-specific increases in physiological arousal and neurotrophic factors levels and meditation-related increases in striatal dopamine, our review revealed overlapping descriptions of consolidation mechanisms associated with attention. As goal-oriented tasks, wakeful interventions share the requirement of increased attention control to maintain task performance. This suggests that states of increased attention control following training might be important for learning outcomes. Distinct from the role of attention during skill training, consolidation would not require attention control to be skill-specific. There is some discrepancy with this view as it has been shown that states of reduced attention demand, including that associated with mind-wandering or default mode states, following training might better serve memory consolidation. This review has highlighted that while attention control might represent a unifying set of processes by which wakeful interventions provide memory consolidation, these processes remain poorly described and lack empirical evaluation.

Kinematic Predictors of Standing Long Jump Distance in Novice Performers

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The standing long jump (SLJ) is often used to assess physical fitness and athletic abilities in various age groups. Several studies have suggested that SLJ performance is determined by a variety of kinematic factors and is positively influenced by use of external focus (EF) cueing compared to internal focus (IF) cueing. Fewer studies, however, have looked at the effects of cueing on the underlying factors that may lead to improved jump performance. The aim of this study was to examine the effects of cueing on projection angle (PA) at take-off and peak lower extremity (LE) joint angles in the CM phase as they relate to SLJ distance in novice performers. Thirty-one participants with no formal training in the SLJ performed seven jumps in a randomized order (no cue=1, IF=3, and EF=3). Jump distance was measured in centimeters (cm). Internal LE joint angles were measured using 3D motion capture. PA was calculated as the angle between the shank and horizontal, immediately after take-off. Statistical analysis included one-way repeated measures ANOVAs and forward linear regressions. P-values<0.05 were considered significant. As expected, the EF cue led to significantly greater jump distance compared to the IF and no cue conditions. The EF cue also significantly led to a more optimal PA (45.5±6°), which predicted about 17-22% of jump distance in the IF and no cue conditions. IF and EF cues significantly reduced peak ankle dorsiflexion (DF) and knee flexion angles compared to no cue. Peak ankle DF had a significant, negative, moderate relationship with jump distance and was identified as a significant predictor of jump distance in all jump conditions (R2=28-33%). These results suggest that cueing, EF cues in particular, leads to better SLJ performance due in part to a more optimal PA at take-off and reduced peak ankle DF and knee flexion in the countermovement phase. However, a significant percentage of jump distance has yet to be accounted for when considering other kinematic factors (e.g. joint velocity), kinetic factors, and/or muscular contributions to the SLJ.

The Effect of Implicit Learning on Motor Performance Under Psychological Pressure: A Meta-Analysis

Daniel Cabral, Auburn University; Alan Wilson, Auburn University; Matthew Miller, Auburn University

Reinvestment theory predicts that motor skills learned implicitly should be less susceptible to deterioration under psychological pressure (i.e., choking) than skills learned more explicitly. In this meta-analysis, we investigated that prediction. A systematic search was conducted for articles that had participants learn a motor skill implicitly relative to a comparison group and had both groups perform the skill under low- and high-pressure conditions. Ten studies with a median of 9 participants/group met the inclusion criteria. Results revealed that participants who learned a motor skill implicitly performed better under a high-pressure condition than a low-pressure condition (Hedges' g_{av} = -1.06, 95% lower CI = -1.75, upper CI = -0.37), whereas participants in the comparison group performed similarly between conditions (Hedges' g_{av} = 0.18, 95% lower CI = -0.25, upper CI = 0.62). For the implicit learning group, funnel plot visual inspection showed an asymmetrical distribution and a significant negative relationship between effect size and precision was found. In conclusion, results confirm reinvestment theory's prediction that implicit motor learning benefits performance under pressure, but the benefit is due to implicit learning improving performance under pressure rather than preventing choking. Furthermore, this effect might be distorted by bias and driven by underpowered studies.

Individualized COgnitive and Motor Learning for the Elderly (ICOME): A Guiding Framework for Enhancing Motor Learning Performance

Russell W. Chan, University of Twente; Rob H. J. Van der Lubbe, University of Twente; Maarten A. Immink, Flinders University; Willem B. Verwey, University of Twente

In the near future, elder adults aged >65 will make up more than 50% of the population in developed countries. It is therefore increasingly important that elder adults maintain the ability to retain and relearn motor functions as this can facilitate an active quality of life for increased health and wellbeing. Current health systems typically rely on a 'one-size-fits all' for motor learning due to limited resources despite wide-ranging differences in physiology, cognitive and motor capacities in the ageing population. We hypothesize that, compared to generic programs, increased benefits are possible when implementing an individualized learning approach, which we call Individualized COgnitive and Motor learning for the Elderly (ICOME). Firstly, to unpack motor sequence learning and related phenomenon such as motor chunks and concatenation, we outline how ICOME is grounded in prominent theoretical sequence learning models like the *Cognitive framework for Sequential Motor Behavior* (Verwey et al., 2015). Cognitive control is an important consideration that generic programs often fail to consider, which we think meditation as a cognitive practice can offer additional enhancement benefits. To monitor changes in cognitive control, we review the use of event-related synchronization/desynchronization (ERS/ERD), a form of frequency decomposition in electroencephalography during motor sequence learning. We specifically target changes in Alpha bandwidth (μ/ mu) of 8 – 13 Hz and Beta bandwidth of 15 – 30 Hz in the ERS/ERD, that are most relevant for changes in cortical activity over the motor cortices during sequence execution. Lastly, we unify the topics with modelling predictions across behavioral and cortical measures to test the effectiveness of the ICOME approach. For example, we predict that using the ICOME approach will result in greater reductions of Beta ERD (pre and post movement) across learning modelled against reaction time reductions, compared to using a generic motor learning approach. Funding source: This

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The Effect of Resistance Training on the Muscle Strength of Rural Elderly

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According to the "Sports Status Survey" of Taiwan's Ministry of Education over the years, most elderly people lack resistance exercises. The elderly with good muscle fitness can strengthen life adaptation and reduce the chance of falls or sarcopenia, thereby reducing the risk of illness, disability, and death. Our team previously reported that a combination of only aerobic exercise and yoga could not improve the elderly's muscle strength. Thus, this study aimed to investigate the effect of a 12-week resistance training program on muscle fitness of rural elderly. The participants were retired farmers, and the program consisted of a 120-minute systemic resistance training class once a week for 12 consecutive weeks. The exercise intensity was maintained above moderate on the Rate of Perceived Exertion Scale. The senior fitness tests, 30-second chair stand test (CST) and 30-second arm curl test (ACT), were applied to evaluate the pre and post-training program's effectiveness. The data were analyzed by GraphPad Prism v9.0 software and presented as mean±standard error of the mean. The data were analyzed by the two-tailed paired *t*-test ($P \leq .05$ is considered significant). Participants were 14 retired farmers from a rural community with an average age of 77.86 (70-88 years old; 71% female). The classes were carried out during their weekly gathering time. Before and after the program, the averaged CST were 12.0±0.44 and 15.9±1.33 stands, and the averaged ACT were 17.6±1.05 and 19.6±1.11 curls, respectively. The training significantly improved the muscle fitness (P=0.001 and 0.022, respectively). Therefore, a 120-minute systemic resistance training class once a week for 12 weeks can improve the elderly's muscle fitness. In the future, it will be interesting to investigate if this short-term training's effectiveness was due to neural adaptation. Funding source: N/A.

The Influence of Gravity on In-Phase Coordination

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With the possibility of commercial space flight and humans going to the Moon in the near future and eventually Mars, it is imperative to understand the influence of gravity on human performance during space exploration. The current investigation was designed to determine the influence of gravity on bimanual coordination. A tilt table was used to simulate gravity on Earth (90° head-up tilt (HUT)), Mars (22.3° HUT), the Moon (9.5° HUT), and microgravity (-6° head-down tilt (HDT)) environments. Right limb dominant participants (N=12) were required to produce a rhythmical 1:1 in-phase coordination pattern by producing a pattern of force with their left and right arms simultaneously. Lissajous information was provided to guide performance. Participants performed 14 practice trials at 90° HUT (Earth). Following a 30 minute rest period participants performed 2 test trials for each gravity environment (Earth, Mars, Moon, microgravity) in a counterbalanced order. Each trial was 30 s. The results indicated that participants were able to effectively perform the task in all four environments and no differences between conditions were observed for measures associated with the timing of the task (inter-peak interval, STD of the inter-peak interval). Interestingly, however, differences were observed for measures associated with force production (mean force, STD of force). Results indicated that mean force production for the left limb was significantly greater for Earth than for the other 3 gravitational environments. Results also indicated force variability was greater for the left limb for Earth than in the microgravity environment. These results suggest that gravity influences our ability to produce and coordinate forces between the limbs and further research should explore the constraints associated with bimanual coordination in various gravitational environments.

Beyond the Biomechanics: How Knee Factors, Physical Activity, Depressed Mood, and Health Modulate the Relationship Between Obesity and Altered Gait

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Obesity alters gait as indicated by shorter, wider steps and decreased gait velocity. However, many individuals with obesity have co-existing conditions that could modulate the relationship between obesity and altered gait. We investigated how knee pain (KP), knee buckling (KB), depressed mood (DM), physical activity (PA), and physical health (PH) modulate the effect of obese BMI on spatiotemporal gait parameters. Forty-one individuals with obesity (40 women, Median Age=48, IQR: 38-51) performed a gait task on a pressure sensitive walkway (GaitRite, CIR Systems Inc., Franklin, NJ) which measured spatiotemporal gait parameters. Participants walked unobstructed down the walkway and crossed an 8 cm obstacle for five trials each. The obstacle magnified altered gait parameters by imposing an external constraint. Participants rated KP using the visual analog scale and reported instances of KB within three months. DM was reported via the Center for Epidemiologic Studies Depression scale, PA was evaluated with the Physical Activity Scale for the Elderly, and PH was evaluated using the SF-12 Health questionnaire. For each independent variable (IV), dependent variable (DV), and mediator/moderator set, we regressed three spatiotemporal DVs (gait velocity, step length, and step width) onto two IVs (BMI and waist circumference), with KP and KB as mediators and DM, PA, and PH as moderators. We found that DM moderated the relationship between obese BMI and step length ($\beta=0.04$, $p \leq 0.05$), waist circumference and step length ($\beta=0.04$, $p \leq 0.05$), and waist circumference and gait velocity ($\beta=0.04$, $p \leq 0.05$) in the baseline condition only. PH also showed a marginal moderation of the relationship between obese BMI and step width ($\beta=0.06$, $p=0.09$) in the obstacle condition only. These results suggest that DM may act to modulate gait in people with obesity, but that participants retain the ability to respond to external constraints. Further, poorer PH may magnify the effects of obesity on gait, such that participants who have obesity and worse PH take wider steps when navigating an obstacle.

Coordination Variability Analyses of Discrete Motor Actions: How Many Trials are Enough?

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For the past several decades, variability analyses of the coordinative relationship between body segments and joints (i.e., coordination variability [CV]) have provided meaningful insight into the behavioral mechanisms and strategies of the motor control system. However, these analyses are almost always performed on continuous tasks, such as walking or running, and these types of tasks typically require numerous trials to assess. The purpose of this study was to determine the minimal number of trials needed to quantify CV in a discrete task; herein the standing long jump (SLJ). Twelve healthy college aged individuals (age 21.4 ± 1.1 yr; height 1.71 ± 0.19 m; mass 71.9 ± 11.9 kg) performed 10 SLJ trials separated by 2-min rests. Instructions were to 'jump as far as you can'.