



JED 2017

Montpellier, le vendredi 2 juin 2017



13^{ème} Journée annuelle de
l'Ecole Doctorale 463
« Sciences du Mouvement Humain »

MOTION SCIENCES & I



Bienvenue à la JED 2017 !

En ce jour de grâce du 2 juin 2017, nous avons les yeux tournés vers l'avenir. Et oui, seulement 10 jours avant le 73^{ème} anniversaire de l'appel du général de Gaulle, les forces vivantes de la nation reprennent enfin esprit... Un petit comité de jeunes étudiants, formés selon les préceptes d'un mouvement bien particulier, décide d'organiser le 13^{ème} des colloques de l'institution ED SMH 463.

En cette journée, seront présentés à la fois oralement et par écrit, les travaux intellectuels menés avec passion par l'ensemble de la communauté du mouvement humain. Cette journée sera aussi la graine qui, espérons-le, germera en d'innovantes et ambitieuses idées de collaborations à venir. Dans cette rudesse du temps, face à la concurrence croissante, seules l'ouverture, l'empathie, la curiosité, le travail et la rigueur mèneront à la consécration tant espérée...

Bien sûr, toutes ces projections n'auraient été possibles, sans le dur labeur mené par nos aïeux. Sans la détermination des recherches passées et actuelles qui ont permis à nos partenaires publics et privés, de nous faire confiance. Nous remercions tous ceux qui ont œuvré et œuvreront au bon déroulement de cette journée: étudiants, chercheurs, entreprises, et plus généralement tous ceux qui se reconnaîtrons dans ce message.

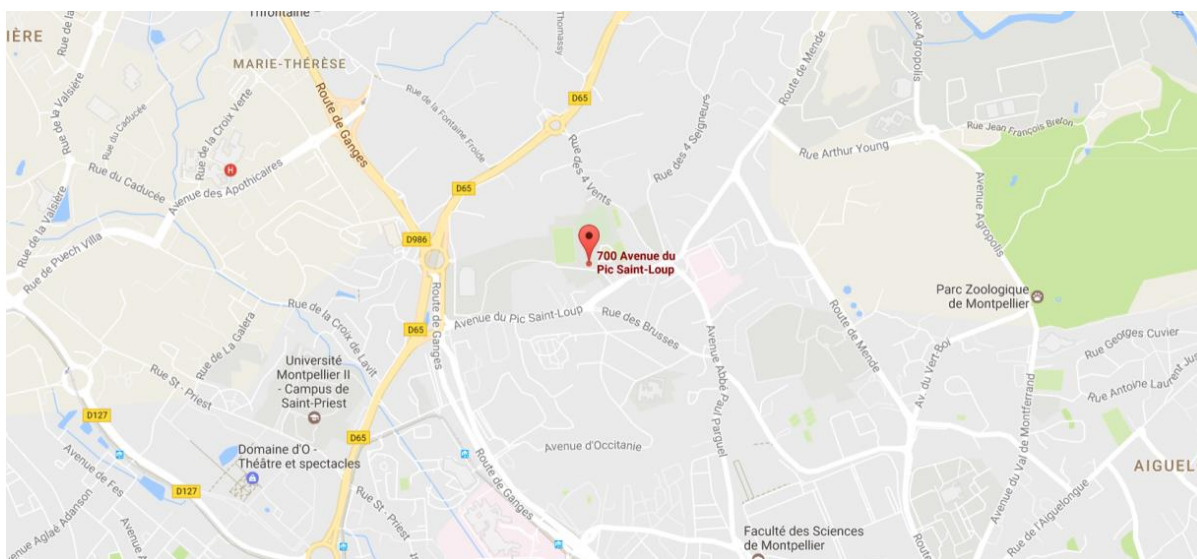
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Le comité d'organisation,

Plan d'accès général

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Déroulement de la journée

08h30	-	Accueil des participants / Petit déjeuner
09h00	-	Discours de Bienvenue et Discours de M. le Directeur de l'École Doctorale (amphi P1)
09h30	-	Première session de communications orales
10h30	-	Pause-café
10h45	-	Deuxième session de communications orales
12h00	-	Repas (Patio EuroMov)
13h00	-	Photo de groupe
13h30	-	Tables rondes: Sciences & I (1 ^{ère} partie)
14h30	-	Communications Affichées (salles de TD)
16h00	-	Tables rondes: Sciences & I (2 ^{ème} partie)
17h00	-	Remise des Prix du Jury et Discours de clôture de la Journée
18h00	-	Cocktail de Networking (Patio EuroMov)
18h45	-	Traditionnelle pétanque
20h30	-	Dîner au Restaurant « Le 10 » (voir plan d'accès en p. 40)

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Petit mot sur les communications orales des doctorants en 3^{ème} année

Ils vont passer par l'épreuve du feu. Celle de présenter un début d'aboutissement de trois années acharnées de recherche, en face de chercheurs expérimentés...

En regardant les différents sujets de recherches on se rend bien compte de l'originalité de notre école doctorale. Ici, les sujets traitent aussi bien de physiologie, psychologie que de biomécanique ou de contrôle moteur. Pour commencer, Macaluso et al. nous présenteront une de leurs manipulations des plus originales qui traitent de l'étude d'adaptations comportementales en apesanteur. Laroche et al., nous parleront ensuite des perceptions de soi en termes d'âge et des stratégies de santé associées à la pratique d'une activité sportive et aux capacités d'adaptation de l'individu dans cette même pratique. Troisièmement, les mystères de l'ingestion de caféine, guarana et de carbohydrate sur la cognition lors d'un effort sous-maximal nous seront partiellement révélés par Pomportes et al. Baati et al. nous éclaireront ensuite sur l'intimité de la myostatine, lipidome et cardiolipide, dans un ménage à trois, au sein du muscle strié squelettique. Plus médical, Sterba et al. ont analysé les caractéristiques individuelles et de la pratique sportive qui augmentent le risque de spondylolyse chez les jeunes athlètes. Nous en apprendrons aussi sur le processus de coordination interpersonnelle dans une perspective dynamique (Almurad et al.). En guise d'avant-dernier, une idée et recherche originale d'un serious-game pour développer le rythme chez des patients ayant des difficultés sera aussi présentée par Begel et al. Pour finir, Charissou et al. nous présenteront les différentes activations des muscles extenseurs de la main lors d'une tâche de flexion sous-maximale.

En vous souhaitant de passer un agréable moment,
Ci-dessous la liste des abstracts des présentations à venir.

Optimal changes of arm kinematics and postural strategy for whole-body reaching movements in weightlessness

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Understanding the impact of weightlessness on human behavior during the forthcoming long-term space missions is of critical importance, especially when considering the efficiency of goal-directed movements in these unusual environments. Several studies provided a large set of evidence that gravity is taken into account during the planning stage of arm reaching movements to optimally anticipate its consequence upon the moving limbs. However, less is known about sensorimotor changes that are required to keep an adequate relationship between an operator and its environment when gravity is removed, especially when the goal-directed action requires a whole-body displacement. We thus aimed at better characterizing kinematic features of whole-body reaching movements in weightlessness. Seven subjects were asked to reach as fast and as accurately as possible toward visual targets while standing during microgravity episodes in parabolic flight. Small and large targets were presented either close or far from the subjects (requiring in the latter case an additional whole-body displacement). Results suggest that the overall spatiotemporal characteristics of the movement (e.g., movement speed) remained close to land observations for the same task. However, our analyses also suggest substantial kinematic changes related to some focal and postural components of whole-body reaching in microgravity. Specifically, when compared to normogravity, the arm deceleration phase was substantially increased. Furthermore, greater whole-body forward displacements due to smaller trunk flexions occurred when reaching far targets in microgravity. Remarkably, these changes of focal kinematics and postural strategy appear close to those reported in our previous study where subjects performed the same task underwater with neutral buoyancy applied on body limbs. These findings may indicate that humans use an optimal control of whole-body, goal-directed actions in weightlessness by rapidly taking into account the absence of gravity in motor preparation and execution (presumably from cues about body limbs unweighting) to maintain sensorimotor efficiency.

Keywords: whole-body reaching, arm kinematics, postural strategy, optimal control, microgravity

Regulatory focus promotion and prevention and behaviors in sport with age

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Regulatory focus theory (Higgins, 1997¹) defines two motivational orientations – promotion and prevention – which guide individuals in the regulation of their behavior (needs, goals, outcomes sought, strategies deployed). These two motivational orientations are regarded in the literature as motivational states (experimentally induced), or as chronic personality predisposition which can vary according to the context studied (e.g. consumption, professional life, health practices...).

In a first stage we aimed to study the effect of health regulatory focus on individuals' behavior in their sports practices according to age. A cross-sectional study was conducted with 513 older adults aged 18-82 years who completed measures of health regulatory focus, adaptive strategies SOC in sport (i.e., *selection, optimization, compensation and loss based selection*), future time perspectives, subjective age, self-rated health, physical self-worth, and leisure physical activity level. The main results showed that (a) a “promotion” health regulatory focus positively predicted leisure physical activity level and adoption of SOC strategies in sport; (b) a “prevention” health regulatory focus negatively predicted leisure physical activity level and adoption of SOC strategies (c) feeling younger than one's age positively predicted health regulatory focus promotion and (d) limited future time perspective positively predicted prevention health regulatory focus. Our present study thus indicates that health regulatory focus is an important determinant of engagement and adaptability in leisure physical activity in adults which varies with age and subjective age.

Furthermore, given the absence in the literature of a tool to measure regulatory focuses in sport, a research program was carried out to construct and validate a scale for measurement.

Keywords: regulatory focus, sport, health, age

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Cognitive performance enhancement induced by caffeine, carbohydrate and guarana mouth rinsing during submaximal exercise

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The aim of this study was to investigate the influence of serial mouth rinsing (MR) with nutritional supplements on cognitive performance (i.e., cognitive control and time perception) during a 40-min submaximal cycling exercise. Twenty-four subjects completed 4 counterbalanced experimental sessions, during which they performed MR with either placebo (PL), carbohydrate (CHO: 1.6 gram/25mL), guarana (GUA: 0.4 gram/25mL) or caffeine (CAF: 67 mg/25mL) before and twice during exercise. Using quantitative and qualitative analyses, the present study provided some important new insights regarding the specific changes in cognitive performance induced by nutritional supplements. The main results were: 1/ CHO, CAF and GUA MR likely lead participants to improve temporal performance, 2/ CAF MR likely improved cognitive control and 3/ CHO MR led to a likely decrease in subjective perception of effort at the end of exercise. Moreover, results have shown that performing 40-min submaximal exercise enhance information processing in terms of both speed and accuracy, improve temporal performance and do not alter cognitive control. The present study opens up new perspectives regarding the use of MR to optimize cognitive performance during physical exercise.

Keywords: nutrition, cognition, perceived exertion, mouth rinse, time-perception task, conflict task

Impact of endurance training on lipid metabolism and phospholipid mitochondrial composition in myostatin deficient muscle

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Inactivation or inhibition of the myostatin (mstn) is considered as a promising treatment for various muscle-wasting disorders [1,2], as induces an increased muscle growth [3]. However, beyond muscle hypertrophy, mstn deficient muscles show a strong fatigability and abnormal mitochondria metabolism [4,5]. Interestingly, endurance training can normalize these phenotypic muscle alterations [6], although the underlying mechanisms remain unknown. Recently, we found that mstn deficiency disturbs muscle lipid metabolism and mitochondrial membrane phospholipid composition, with a decrease in cardiolipin proportion, a specific mitochondrial phospholipid which plays a functional role of mitochondrial bioenergetics [7]. In this study, we wanted to assess whether endurance training might impact lipid metabolism and mitochondrial lipid composition. We performed lipidomic analysis of skeletal muscle from wild-type and KO mice before and following 4 weeks of endurance training. We confirmed a decrease both in oxidative and lipogenesis pathways in KO muscle at the basal state. Endurance training improved significantly running performance, and oxidative and lipid metabolism in the two genotypes, illustrated by an increase in markers of both oxidative and lipogenesis pathways (CPT1, PPAR- δ , Citrate synthase, FAS) suggesting a greater tolerance to use lipids. Furthermore, endurance training restored slightly but significantly the proportion of cardiolipin in the mitochondrial membrane from mstn KO muscle, in association with improved mitochondria metabolism. These results suggest that cardiolipin pathway could be a new track to improve mstn KO muscle metabolism and restore altered mitochondrial function.

Keywords: GDF-8, thin layer chromatography, delta-9 desaturase, neutral lipids, free fatty acids

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Biomechanical analysis of spino-pelvic postural configurations subjected to various sport-related loading conditions in spondylolysis

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Spondylolysis is a stress fracture of the pars prevalent among young athletes [1]. Clinical studies suggested a higher risk of spondylolysis for sportspersons with high SS and PI due to shear mechanisms [2]. However, the stress conditions in the pars, linked with the risk of spondylolysis, due to sport-related loads and intrinsic postural parameters were not yet studied. The objective was to numerically assess the influence of SS on the stress in the pars under combined loads.

An osseo-disco-ligamentous L4-S1 finite element model was built for three cases with spondylolysis (SS=32°, 47°, 59° and PI=49°, 58°, 72° respectively) representing three different spino-pelvic configurations. After simulating the standing posture, 16 loading conditions were applied by combining four loads (compression, sagittal and lateral bending and axial torque). For each simulation, the Von Mises stress, maximal L5-S1 facet contact force and resultants internal load in the L5-S1 disc were computed.

The maximal stress was 15% higher for the case with the highest SS (59°) compared to the one with lowest SS (32°) (p=0.0029). The maximal percentage of volume of cancellous bone in the pars with stress higher than 75% of the ultimate stress (highly stressed bone) was 18.7%, 7.1% and 6.8% for the cases with SS=59°, 47° and 32° respectively (p<0.001). For all simulations, the maximal stress and volume of highly stressed bone were higher when an axial load of 900N was simulated (2.1 MPa and 4.8% respectively) compared to simulation with only the upper body weight (300N) (1.36 MPa and 0.76%) (p<0.001). Combined 10Nm flexion, axial torque of 6Nm and compression of 900N generated the highest stress conditions, and L5-S1 facet contact force.

Combined movements of flexion and axial rotation with compression generated the highest stress conditions related to risks of spondylolysis. Such stress conditions intensify with increased PI and SS.

Keywords: biomechanics, spondylolysis, lumbar spine, finite element model, spino-pelvic parameters

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Complexity matching in side-by-side walking

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The interpersonal synchronization (IS) are still poorly understood, and several theoretical frameworks have been proposed: The information-processing approach suggests that IS is based on representational processes of anticipation [1]; The coordination dynamics perspective considers that IS could be accounted for by models of coupled oscillators [2]; The complexity matching hypothesis suggests that IS could be based on a global exchange of information between systems [3]. We propose three statistical tests for disentangling these hypotheses: correlations between multifractal spectra [4], cross-correlations between series and a windowed cross-correlation analysis [5], which allows to distinguish between coordination dynamics and complexity matching. **Methods:** 13 dyads involved in the experiment and they performed synchronized walking in three conditions: independent, side-by-side, and arm-in-arm walking. **Results:** The analysis of correlations between multifractal spectra and the cross-correlation analysis clearly rejected the information-processing hypothesis. The windowed cross-correlation analysis showed that the averaged lag 0 cross-correlation was non significant, a result consistent with the complexity matching hypothesis. **Discussion:** The results present evidence for the presence of a complexity matching effect in synchronized walking conditions. This result has important implications, especially for rehabilitation purposes. A typical loss of complexity in elderly has been reported [6]. Complexity matching offers some interesting perspectives in this regard. If an elderly person is invited to walk in synchrony with a young and healthy companion.

Keywords: synchronized walking, complexity matching, multifractals, cross-correlation

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Rhythm Workers: a music-based game for training rhythm skills

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The capacity to process rhythm is widespread in humans. However, rhythmic skills can be impaired in several developmental or neurological pathologies. To date, there is no specific tool to train rhythmic skills. Here we present a new protocol for training rhythmic skills via a serious game (Rhythm Workers) implemented on a tablet device. The musical material used in the protocol was selected in a first Experiment. The goal was to select musical excerpts for which it was progressively more difficult to track their beat. To this aim 18 non-musicians tapped to the beat of 99 musical excerpts. Based on measures of consistency and accuracy of synchronization, the excerpts were sorted in terms of the difficulty to track their beat. Excerpts were assigned to different difficulty levels in the training protocol. In a second Experiment, the Rhythm Workers protocol was devised and tested in a proof-of-concept study. One version of Rhythm Workers involved a synchronized motor response (via tapping); another version implied a purely perceptual task. Ten participants were trained with the synchronization version, and 10 with the perceptual version of Rhythm Workers, for 2 weeks. A control group ($n = 10$) did not receive any training. The participants showed high compliance and motivation in playing the game. A significant improvement in rhythmic skills was observed with both version of the game, as compared to controls. In sum, *Rhythm Workers* appears as a motivating and efficient way to train rhythmic abilities in healthy young adults.

Keywords: rhythm, serious game, rehabilitation, movement, training

Functional relevance of correlated neural inputs in the regulation of antagonist activity during submaximal isometric fingers flexion tasks

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Antagonist muscle activity plays crucial roles during voluntary contraction, especially in joint stiffness, stability and impedance. Previous studies evidenced common neural inputs as a mechanism responsible for the coordinated activation of hand muscles, but its functional relevance to the modulation of antagonist activity remains to be established. Correlated neural inputs can be quantified by across-muscle coherence between electromyographic (EMG) signals. Interestingly, the contribution of hand extensors differs according to hand configuration for a same functional demand to flex the fingers. The aim of this study was to compare EMG-EMG coherence during fingers flexion performed in different hand configurations while controlling agonist muscle force to gain insights into neural mechanisms underlying the regulation of antagonist muscles activity.

Twenty-four participants performed submaximal isometric fingers flexions in two hand configurations: power grip (*Power*) and finger-pulling (*Pull*). The required net force was set based on pilot results obtained from hand musculoskeletal modeling, so that mean agonist muscle force was 150 N in both configurations. EMG-EMG coherence analysis was performed in beta-range (15-35 Hz) between key wrist and fingers flexors and extensors muscle pairs. Wilcoxon tests were used to identify differences in EMG-EMG coherence at comparable net force value and force level between hand configurations ($\alpha = 0.05$).

Our main results showed higher magnitude of beta EMG-EMG coherence for FCR/ECR, FCR/EDC, FDS/ECR, FDS/EDC and FCR/FDS muscle pairs in *Power* than in *Pull*, while no significant difference was found for ECR/EDC (Fig. 1).

These results supported a relationship between changes in EMG-EMG coherence and the modulation of antagonist muscles activity at similar agonist and both absolute and relative force values between hand configurations. Our findings suggest the involvement of correlated neural inputs as a functional mechanism that could govern the regulation of antagonist muscles activity according to task constraints.

Keywords: antagonist activity, wavelet-based intermuscular coherence, muscle tensions, neural control

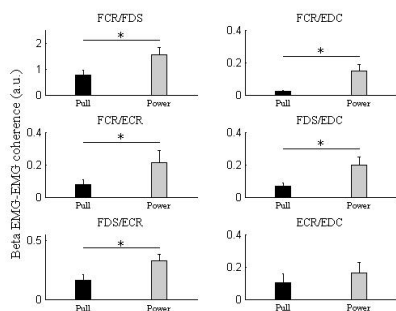


Figure 1: EMG-EMG coherence values in the beta-range (15-35 Hz, β) for FCR/FDS, FCR/EDC, FCR/ECR, FDS/EDC, FDS/ECR and ECR/EDC muscle pairs during submaximal voluntary isometric flexion contraction of the fingers in *Pull* and *Power*. FCR, FDS, ECR and EDC stand for flexor carpi radialis, flexor digitorum superficialis, extensor carpi radialis and extensor digitorum communis, respectively. * Indicates a significant Configuration effect.



Communications Affichées

Overexpression of G6PD delays the onset of frailty in mice

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Frailty is a clinical syndrome associated with the aging process, which leads to a decreased physical function [1]. The damages induced by reactive oxygen species (ROS) in cells accentuate this process. The antioxidant system is largely based on the reducing power of NADPH [2], whose levels are mainly determined by the enzyme glucose-6-phosphate dehydrogenase (G6PD) [3]. Using a specific model of G6PD-Tg mice, the aim of this work was to establish whether overexpression of G6PD delays frailty in experimental animals.

A cohort of WT and G6PD-Tg female mice of different ages were used: 18-20; 21-22; 23-24; and 25-26 months. We measured on each mouse 5 parameters to establish a score for frailty based on the construct described by Linda Fried [4]: body weight, motor coordination, maximal grip strength, endurance, and slowness. Each criterion had a designated cutoff point to identify the mice with the lowest performance.

Our results show that G6PD-Tg mice tend to maintain better their weight while they age, than the WT. Moreover, 18-20 months old G6PD-Tg animals performed better in the motor coordination test than the WT. At the age of 23-24 months, 40% of mice in the WT group were considered frail for maximal strength vs 0% in the G6PD-Tg group. Results of the treadmill test do not show a better performance in running speed and time in the G6PD-Tg mice compared to WT. Taking into account the 5 parameters determined, we have found that the percentage of older mice considered as frail is higher in the WT than in the G6PD-Tg group. Finally, overexpression of G6PD in mice prevents frailty in 23 to 26 months old mice.

Keywords: frailty, Glucose-6-Phosphate Dehydrogenase, aging

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Analyse physiologique et biomécanique du mode de propulsion asynchrone chez des basketteurs en fauteuil roulant manuel

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Deux modes de propulsion en fauteuil roulant manuel (FRM) existent : le mode synchrone (Syn) dans lequel les bras travaillent ensemble, et le mode asynchrone (Asy) dans lequel les bras travaillent en alternance [1]. Il a été montré que les conditions de terrain peuvent être reproduites sur le tapis roulant pour le mode Syn [2]. Ce qui n'a pas été démontré pour le mode Asy, du fait du steering sur le terrain. L'objectif est de comparer les réponses physiologiques et biomécaniques du mode Asy sur le terrain vs sur le tapis roulant. Notre hypothèse est que les paramètres physiologiques et biomécaniques sont plus importants sur le terrain.

11 joueurs de handibasket ont participé à cette étude. 1 session de 4 minutes à 8 km.h⁻¹ est réalisée sur le tapis roulant et 1 session sur le terrain (tests de la « figure en 8 »). Le FRM est équipé d'une roue instrumentée pour mesurer les paramètres temporels du cycle de propulsion : Temps de Poussée (TP), Temps de Récupération (TR) et Temps de Cycle (TC=TP+TR). La consommation d'oxygène par kilogramme (Vo₂.kg⁻¹) est recueillie par un K4. La lactatémie est mesurée avant et après chaque test.

Les premiers résultats ne montrent pas de différence significative pour le TP, le TR, le TC et pour la lactatémie. Cependant, la Vo₂.kg⁻¹ est supérieure sur le terrain vs tapis ($p < 0,01$).

Nous pouvons conclure que l'utilisation du tapis roulant pour évaluer la technique de propulsion n'est pas recommandée. En effet, bien que les paramètres temporels du cycle de propulsion ne soient pas modifiés de manière significative, la Vo₂.kg⁻¹, en condition de propulsion sous maximale, est influencée par le test effectué, sûrement en raison du steering. Ces différences permettraient de préconiser le terrain comme lieu de test pour le réentraînement à l'effort ou l'évaluation des sportifs en FRM.

Keywords: propulsion asynchrone, tapis roulant, test de terrain

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Investigation of eating and deviant behaviors in bodybuilders according to their competitive engagement

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Influenced by the thin and muscular body ideal, some men choose to practice bodybuilding and adopt a strict regime to conform with these beauty standards [4]. Bodybuilding practice may be considered at risk in the development of eating disorders and doping use, specifically in competitive bodybuilders [1]. Some psychological factors have been related with the development of these deviant behaviours: body dissatisfaction [4], sport motivation [2], sport dependence [3], and some psychological traits such as perfectionism and anxiety [4]. Although previous quantitative studies [1] compared competitive to non-competitive bodybuilders on a wide range of behaviors, to date none explored the characteristics of athletes moving to competition. This intermediate period that can foster performance goals [5] might be critical in the development of deviations. The purposes of this study were: (a) to explore eating behaviours (i.e., alimentation and supplementation) and their potential deviations in non-competitive, future competitive, and competitive male bodybuilders; (b) to identify the associated psychosocial factors to these behaviours in each of the three categories of bodybuilders. Semi-structured interviews were conducted with twelve volunteer bodybuilders: 4 “non-competitive bodybuilders”, 4 “future competitive bodybuilders”, and 4 “competitive bodybuilders”. The transcripts were analysed using content analysis. Results revealed that, compared to their non-competitive and competitive counterparts, future competitive bodybuilders displayed specific dietary strategies and deviant behaviors (e.g. eating disorders, doping; social exclusion; sport dependence). The development of performance goals and increasing drive for muscularity among future competitors could explain the development of these deviations. This qualitative study suggests that future competitive bodybuilders might be particularly at risk in the development of deviant behaviours related to eating, doping use, and social relationships. Future studies should try to better identify the psychological mechanisms underlying this development in order to optimize prevention strategies.

Keywords: disordered eating, doping, body dissatisfaction, sport motivation, bodybuilding

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Comparison of work-matched high vs. moderate exercise intensity on endurance performance in rat

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Endurance exercise is not only beneficial for athlete performance but also play a preventive and curative role in cardiovascular, metabolic and neurodegenerative diseases. Moderate-intensity continuous training (MOD) is the most frequently used but its beneficial effects are limited [1]. To avoid a plateau of performance, high-intensity interval training (HIT) enables to further improve performance [2]. Nevertheless, the different physiological adaptations induced by HIT compared to work-matched MOD remain controversial at muscular as well as at cerebral levels that are never measured on the same protocol [3,4]. This study aim to compare work-matched HIT and MOD programs on endurance performance as well muscular and cerebral plasticity. Healthy rats were randomised in Control, HIT and MOD groups. An incremental test was performed at PRE training, D14, D28 and D56 in order to identify the running speed associated with the lactate threshold and the maximal speed. Western blot analysis was performed for cerebral and muscular proteins at D30 or D58 (4 and 8 week respectively) *lateralis* and *medialis gastrocnemii* muscles. Immunostaining was performed on *soleus* muscle. Global protein synthesis (puromycin) was also assessed at cortex-hippocampus and muscle levels. Preliminary result showed that HIT was more effective to improve both S_{LT} at D14 and D56 ($+52.3\pm 23.7\%$ and $+78.7\pm 30.4\%$, respectively) compared to MOD ($+37.2\pm 21.2\%$ and $+44.5\pm 29.6\%$, at D14 and D56 for S_{LT}) but only at D56 for S_{max} ($+64.5\pm 22.6\%$ for HIT and $+37.1\pm 31.2\%$ for MOD). Our results suggested that performance gains induced by work-matched HIT on healthy rats might be related to different muscular and cerebral plasticity. Such measurements are ongoing.

Keywords: PGC1- α , FNDC5, Interval exercise, BDNF, Lactate threshold

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Mapping individual and social postural signatures

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Individuals are unique in the way they stand or move. Yet, individuals often adapt their postures and gestures to successfully interact with others. Here, we report a method able to capture both individual and social postural dynamics in order to compare them. After recording the centre of pressure in the antero-posterior direction during a solo or duo postural improvisation task, we estimated the probability density function (PDF) of the participant's movement. PDFs were compared to each others using the earth mover's distance, a distance metric that reveals how similar two histograms are [1]. Multidimensional scaling was then used to provide a two-dimensional visual representation of the distances (similarity) between PDFs. In this way, we demonstrated the existence of individual postural signatures from nine participants improvising during 3 weeks (1 weekly session of 3 one-minute trials). In particular, we revealed two essential features of these signatures, i.e., that they were time-persistent and that they differed significantly from those of others. Further, in the presence of others, we discovered that participants tend to change their individual postural signatures towards a common signature called here a social postural signature. Our findings allow us to better understand the inter-relations between individuals and social behaviours.

Keywords: postural signatures, movement dynamics, statistical analysis, mathematical modelling

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Analyse et optimisation des interactions membre/prothèse dans les cas d'amputation des membres inférieurs

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En 2050, le nombre de personnes amputées aux États Unis sera de 3.6 millions. L'épidémiologie est en premier lieu vasculaire (diabète), traumatique, et cancéreuse. Le nombre d'amputés effectivement équipés d'une prothèse est estimé à 40%. Une grande proportion des amputés souffres de douleurs chroniques à l'interface moignon/prothèse. Il n'y a pas de consensus sur les critères à adopter pour garantir une conception de prothèse optimale et leur réalisation est encore très souvent artisanale. L'objectif de ce projet est l'identification des critères d'évaluation de la bonne adaptation d'une prothèse à un patient donné. Il s'agit de déterminer les relations éventuelles entre interaction mécanique moignon/prothèse et des critères biomécaniques qui devront être de bons indicateurs du confort du patient et de l'efficacité de la prothèse.

Les mesures de pressions sont étudiées sur un pas pendant un test durant lequel. Neuf capteurs FSR ont été utilisés pour mesurer la pression d'interface entre le moignon et l'emboiture.

Les pressions obtenues lors du test dynamique varient entre 22.30 et 78.27±17.55 kPa lors de la charge, de 4.70 à 77.35±26.37 kPa en mi-pas, de 1913 à 77.78±17.71 kPa en décharge. Lorsque la prothèse est en suspension, le minimum de pression mesurée varie sur l'ensemble des capteurs entre 0 et 29.13±9.99, puis se stabilise entre 0 et 26.35±8.69 kPa. Le maximum de pression pendant la marche se situe au niveau des capteurs antérieur bas et intérieur supérieur.

Nos mesures montrent que les pressions sont plus importantes sur la zone antérieure comme ce qui a été montré précédemment [1]. La littérature montre que ces pressions atteignent 90 kPa pour des mesures dynamiques dans des escaliers, ce qui est très supérieur à nos résultats sur un terrain plat et à vitesse de confort. Si dans la littérature, la variabilité des mesures est due aux différentes méthodes d'acquisition [2].

Keywords: amputation, prothèse, optimisation, confort, emboiture

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3 days of human dry immersion leads to an early vastus lateralis remodeling

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Chronic inactivity and microgravity induce skeletal muscle deconditioning that translates into loss of mass and strength, as well as an increase of muscle fatigability. The dry immersion model, by suppressing all support zones, accurately reproduces the effects of microgravity.

Twelve healthy volunteers (32±5yrs) completed 3 days of DI. Muscle function was investigated through maximal voluntary contraction (MVC) tests. Several constants were analyzed for characterize the dry immersion effect. Structural experiments were performed using MRI analysis for measuring the quadriceps CSA, MyotonPro device to measure the muscle tone. Finally invasive experiments on muscle fibers were performed to characterize changes in myotypology.

Our results indicated a significant 9.1% decrease of the normalized MVC constant (P=0.048). Contraction and relaxation modelization kinetics reported modifications related to the torque generation ($k_{ACT}=-29\%$; P=0.014) and to the relaxation phase ($k_{REL}=+34\%$; P=0.040) after 3 days of DI. Our results indicated equally a significant atrophy of type I muscle fibers (-10.6%±12.1, P<0.05), an increase proportion of hybrid, type I/II fiber co-expression, and an increase by 6-fold of NCAM+ muscle fibers suggesting an early muscle deconditioning and denervation process (P<0.01). Transcriptome analysis, using RNA-seq analysis, reported a differential expression of 2872 genes after 3 days of DI, among them, 438 genes with a differential expression up to 0.6 in Log₂ fold-change. This large-scale analysis allows us to identify several groups of differential genes and pathways affected by 3 days of DI, related for example to the muscular contraction, the lipid metabolism, and to the glycogen synthesis.

Our results contribute to deciphering the early molecular signature of skeletal muscle deconditioning. This experiment should be the basis for further studies to evaluate the potential effects of different countermeasures.

Keywords: skeletal muscle deconditioning, microgravity, atrophy, transcriptome, protein balance

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Bio-inspired celestial compass for a hexapod walking robot in outdoor environment.

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Insects like ants and bees have photoreceptors in their *Dorsal Rim Area* sensitive to the skylight polarization pattern [1]. Taking inspiration from insects allows us to develop smart sensors. A bio-inspired celestial compass has been developed in the aim of stabilizing the heading of a hexapod robot (Fig. 1), which can estimate its heading from the linearly polarized skylight in the UV-range. Field results will be presented and will show their reliability and accuracy despite various weather conditions. Finally, our celestial compass can be used as an alternative to magnetometers in highly disturbed environment or in case of magnetometers failure [2].

Keywords: bio-inspired sensor, polarized light, field robotics, autonomous navigation

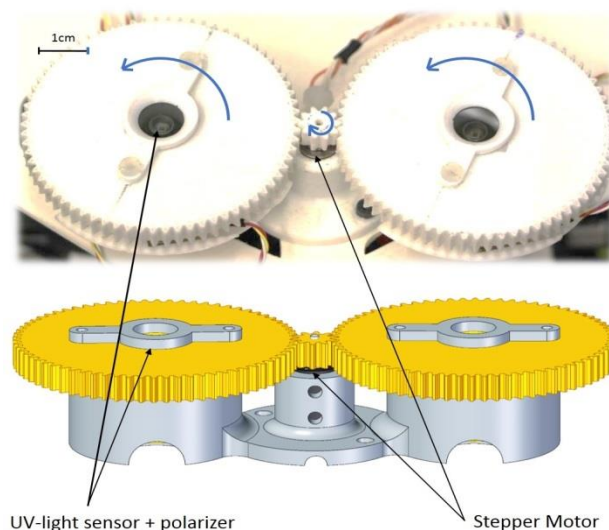


Figure 1 - UV-polarized light optical sensor

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Short trail running race: Beyond the classic model for predicting running performance

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Purpose: The duration of short Trail Running races (TR) is similar to traditional level distance running (e.g. road marathon), but the uphill-downhill course has major physiological and mechanical consequences on muscle actions. We tested if the classic physiological model of level running performance was adapted to TR, or if it could be improved by including specific muscular factors. **Methods:** Nine high-level male trail runners performed laboratory testing during which physiological (maximal oxygen uptake VO_{2max} , fraction of VO_{2max} used at lactate threshold $\%VO_{2max}$ and running economy RE) and knee extensors strength endurance (SE) variables were measured. TR performance was assessed during an official race (27 km, 1400-m positive/negative elevation change). Pearson's correlation test was used to determine the variables related to TR performance and a stepwise model selection procedure was used to establish the most powerful model of TR performance. **Results:** SE and VO_{2max} showed the two highest correlations with TR performance ($r = 0.91$ and $r = -0.76$). The multiple linear regression analysis using the same independent variables as the classic model of endurance running (VO_{2max} , $\%VO_{2max}$, and RE) produced a non-significant model summary ($r^2 = 0.481$), but adding SE improved the model ($r^2 = 0.967$). The stepwise analysis showed that SE alone explained 76.9% of the total variance in TR performance, VO_{2max} accounted for an additional 15.2%, and uphill RE brought a third significant variable (5.7% of the total variance). **Conclusion:** In well-trained trail runners, strength endurance showed the highest correlation with trail running performance. Adding muscle strength endurance and uphill running economy to the classic endurance model of performance led to a refined model specific to short trail running.

Keywords: mountain running, strength, running economy, isokinetics, fatigue

Effects of shoe energy return and bending stiffness on running economy and ground reaction forces

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Shoe midsole characteristics can improve running economy [1,2], a common indicator of running performance [3]. Potentially due to a lack of available analysis method, ground reaction force alteration has never been linked to running economy changes following midsole modifications. The purpose of this study was to investigate effects of energy return and bending stiffness on running economy and ground reaction force during running. Nineteen healthy male recreational runners performed eight minutes submaximal running trials with four shoe conditions. Shoe conditions combined high or low energy return with high or low bending stiffness. Shoe effects were assessed through running economy (with classical statistical procedure) and time course of ground reaction force components during the whole stance phase (with statistical parametric mapping procedure) [4]. Running economy was not affected by shoe characteristics modifications. Effects of midsole mechanical characteristics were observed on ground reaction force components with low energy return decreasing force values during the braking phase, and high bending stiffness decreasing force values during the propulsion phase. Acting during key phases of stance, suitable energy return and bending stiffness altered ground reaction force but did not seem to save energy cost during short-term submaximal running. Further studies should assess kinematics, dynamics and muscle activity to understand biomechanical pattern changes associated with these shoe characteristics.

Keywords: footwear, performance, propulsion, bending stiffness, energy return

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Complement activation by pulp capping materials plays a significant role in both inflammatory and pulp stem cells' recruitment

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The role of Complement, especially through the C5a fragment, is well known for the initiation of inflammation [1]. Its involvement in the regeneration has been demonstrated more recently by the recruitment of mesenchymal stem cells [2]. C5a can be produced locally by the pulp fibroblasts in response to injury or infection [3]. This work aims to investigate the effect of different pulp capping biomaterials on Complement activation and its possible influence on inflammatory and pulp stem cell recruitment.

Conditioned media were prepared from three pulp capping biomaterials: Biodentine™, TheraCal® and Xeno®III. Injured pulp fibroblasts were cultured with these conditioned media to analyze C5a secretion by ELISA. Dental pulp stem cells (DPSCs) were isolated from human third molar explants by magnetic cell sorting with STRO-1 antibodies [2]. Expression of C5a receptor on DPSCs and inflammatory cells (THP-1) was investigated by immunofluorescence. Migration of both DPSCs and THP-1 cells was studied in Boyden chambers.

Pulp fibroblast production of C5a significantly increased when the cells were incubated with TheraCal® and Xeno®III conditioned media. Recruitment of cells involved in inflammation (THP-1) was significantly reduced by Biodentine™ and TheraCal® conditioned media while the migration of DPSCs was reduced with TheraCal® and Xeno®III conditioned media but not with that of Biodentine™. The involvement of C5a in cell recruitment is demonstrated with C5a receptor specific antagonist (W54011).

After pulp injury, the pulp capping material affects Complement activation and the balance between inflammation and regeneration through a differential recruitment of DPSCs or inflammatory cells.

Keywords: complement, pulp capping biomaterials, dentin-pulp regeneration, cell migration.

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Slow variables of epileptiform activity: metabolic candidates and computational properties

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Ion-based neuron models implement the effects of charge displacements due to trans-membrane currents on the overall concentrations of the ion species involved in the neuron's spiking mechanism. After a spiking period, such charge displacements sum up and we can observe an evolution of ionic concentrations on a much slower time-scale than spiking dynamics'. This evolution in turns affects the neuron's firing patterns. In the repertoire of behaviours of such models, we focus on the ionic-oscillation-induced bursting patterns of a HH-type model embedded in an infinite potassium bath [1,2]. We consider a HH-type neuron K^+ , Na^+ , Ca^{2+} , Cl^- and ATP-pump currents, and receiving stationary poisson synaptic input. The conductance-based equations for this model are coupled to the equations describing the change of ionic concentrations in the intracellular and extracellular space, as well as to the equation for passive diffusion from the K^+ bath. We obtain a set of 5 variables using constraints upon mass/charge and time scale separation. A 2D bifurcation diagram of the fast subsystem, comprised of membrane potential and K^+ activation variable, is obtained for each couple of values of two slow variables (intra- and extracellular shift of K^+ concentration from resting values) with fixed intracellular calcium concentration. Varying the latter variable we obtain a 3D bif. diagram. The passive diffusion from external K^+ -bath induces a slow-wave bursting behaviour of the neuron for a certain range of bath concentrations. This can be visualized as a closed trajectory in the slow-variables' space. Our model is able to combine physiological realism and computational convenience to reproduce a K^+ -elevation-induced bursting, and potentially, with its implementation of neuro-glial biochemical coupling, other known bursting mechanisms that might correspond to different trajectories in the slow-variable's space. Another valuable promise for the future is the translation of this model to a population formalism, through mean-field techniques.

Keywords: epilepsy, bursting, biophysics

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Development of the Sport Confrontations Scale: measuring sports experiences liked by adolescents through remembered utilities

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The motivation, conceptualized as reasons of peoples' behavior, for sport participation has been widely explored through self-determination theory (Decy & Ryan, 2000). Intrinsic motivation 'IM' is consistently associated with well-being and long-term adherence to sport. The authors also stated that IM is characterized by doing an activity for itself, for its own interest or pleasure, and that those characteristics of the experiences are indissociably associated with IM behaviors. This assumptions followed the logic of a more general theoretic viewpoint of human behavior -came from Bentham (1789)- that behavior is governed by the motives of improve pleasure and avoid pain. More specifically, in sport, Dishman (1985) noted that "*feelings of enjoyment and well-being seem to be stronger motives for continued participation [than] knowledge of and belief in the health benefits of physical activity*" (p. 162). According to that, it is now well-known that positive affective responses during exercise predict short and long term future participation (Williams, 2008, 2012; Baldwin et al., 2013; Rhodes & Kates, 2015) and future intention for participation (Kiviniemi et al., 2007; Wang, 2011; Rhodes & Kates, 2015). Most part of these studies have worked on the exercise intensity. In another hand, sport practice is also characterized by a lot of different situations. For example, players could be in situation of performance improvement, new skill mastery, competition with others people, fighting, feeling of injustice and a huge amount of others situations. In regards with previous findings in motivation research, it is clear that pleasure elicited by specific sports experiences (remembered utilities) could be related to IM of participants, and thus to their long-term adherence. To our knowledge, no scale in sport exists with the aim of known in a large sample of athletes what kind of sports experiences they like? This is the main purpose of this study.

Keywords: self-determination theory; remembered utility; intrinsic motivation; sports experiences

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The role of the automatic processes in the adoption of physical activity behavior

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Introduction: A big part of non-communicable diseases is associated with habits. These are automatic answers to the specific cues of the environment (Verplanken, 2006). The Generic Multifaceted Automaticity Scale (GMAS) was developed and validated in French (Boiché et al., 2016) to measure the facets of the automaticity (Bargh, 1994): i) (un) intentionally to activate behaviour, ii) (un) controllability of the adoption of behaviour, and iii) the efficiency on the execution of the behaviour. The first study examined the validity of the GMAS in Spanish. The second study aimed at testing the contribution of the automaticity in the adoption of active modes of transportation (AMT). **Study 1. Methodology:** 105 adults filled out the GMAS about physical activities. One week later, they filled out the International Physical Activity Questionnaire (Lee et al., 2011) measuring their level of physical activity (N = 40). **Results:** A Confirmatory Factorial Analysis (CFA) supported the model in 3 factors [$\chi^2/df = 2.38$; TLI = .89; CFI = .93; RMSEA = .11; 90 % IC [0.08-0.15]]. The internal consistency was satisfactory (unintentionally = .81, control = .73, efficiency = .78; Automaticity = .89). Intense, moderate and global physical activity ($r = .37$; $r = .36$; $r = .48$; $p < 0.05$) were significantly correlated to the automaticity. **Study 2.** 151 students (M = 22,52 years) filled out the GMAS towards the AMT as well and their intentions to adopt it. One week later (N = 58), the percentage of AMT was reported. **Results:** A multiple regression revealed that the adoption of AMT was significantly predicted by the automaticity ($\beta = .29$; $p < .05$) but not by the intentions ($\beta = .09$; $p < .50$). **Conclusion:** The GMAS is a valid instrument in Spanish and the automaticity contributes in a significant way to the adoption of AMT in Spanish populations.

Keywords: habits, automaticity, physical activity

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Does the loss of proprioception result in advantages or deficits when wearing prisms? Implications for movement planning and adaptation

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Sensorimotor adaptation has been studied by assessing reaching arm performance while facing a visual perturbation such as prisms [1]. Questions remain about the role of proprioception in visuomotor adaptation. The current view is that adaptation reflects the updating of an internal model of the sensorimotor system. As these properties may change, predicted state and sensed state do not match until the internal model is updated, such as to regain an optimal level of performance.

To study the impact of proprioceptive inputs on the mechanisms underlying visuomotor adaptation, a prism-adaptation paradigm was tested on healthy-control participants and two deafferented participants. They both had an acute sensory neuronopathy, which resulted in a complete loss of touch, vibration, pressure and kinesthetic senses below the nose (GL) or below the neck (IW). Participants had to reach for visual targets with the dominant arm, and full vision, in Pre-Exposure (30 trials), Prisms Exposure (100 trials) and Post-Exposure (30 trials). Prisms deviated the visual field by 17° to the right. Deafferented participants have no proprioception, so no prism adaptation should be expected for them if a visuo-proprioceptive mismatch is the sole mechanism driving adaptation.

Results show that the deafferented participants do adapt their reaching behavior to the prisms, as shown by the significant, leftward after-effects (-6.0° for GL, -16.8° for IW). Differences between the two participants may be due to the neck proprioceptive inputs [2] that IW has but not GL. While deafferented participants may be experts at processing of visual information [3], our results suggest that visuomotor adaptation is primarily driven by a mismatch between the predicted outcome of the motor commands and visual information.

Keywords: motor control, adaptation, proprioception, reaching, deafferentation

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Stress shielding post total knee replacement, the influence of muscles. A finite element study

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Introduction. Aseptic loosening is one of the main cause of failure of total knee replacement (TKR), this can be caused by stress shielding leading to bone stock reduction. Most studies evaluate numerically the performance of TKR without accounting for the muscles forces. We wonder if they could influence stress shielding. **Methods.** Four finite elements models of the same tibia were created, one with and one without muscles both with and without implant. Forces were applied to simulate a gait cycle. And ratio of pre- and post-implantation von Mises stress were compared. **Results and Discussion.** There were sensible differences in the stress fields for the model with and without muscles, the implant stem tip was less loaded with muscles. However, the stress shielding field were similar, and it appears that neglecting the muscles have little influence on the stress shielding. This is coherent with a study on unicompartmental knee replacement. Our study suffers from its lack of subjects, also we applied same forces on pre- and post-implantation models while gait is modified by the TKR surgical operation.

Keywords: finite element analysis, total knee replacement, muscles, stress shielding

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Adolescents' sport practice and motives for sport activity: A comparison between Austria and the South of France

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Sport practice during adolescence is a predictor of PA and sport practice in adulthood [1,2]. Therefore, in the short and in the long term, adolescents' adherence to sport activity represents a key role regarding public health in Europe. Existing literature highlights the "clear need for cross-country comparisons of physical activity prevalence in Europe" [3]. This present study investigates European adolescents' sport activity and health. The data collection was conducted in France and Austria between February and April 2015. The overall objective of our findings is to compare, reason as well as interpret Austrian and Southern French students' sports practice and motives for sport activity by taking cultural differences into consideration. Austria, underlying a rather Germanic culture, in contrast with the South of France, representing the culture of Southern European countries, delineate an interesting test case. The similarities and differences between Southern French and Austrian adolescents' sport participation characteristics are discussed in a first scientific paper. The next paper is going to investigate adolescents' motives for sport activity in the European countries of Austria and France. The identification of adolescents' sport motives and sport characteristics, e.g. their preferred sport context/ types of sport, helps to detect young people's preferences for sport activity as well as to identify specific contexts of declining sport activity and hereinafter, to target them by intervention. In other words, adapted sport promotion programs for adolescents and public health policies can enhance the general well being in occidental cultures in the long term.

Keywords: adolescents, sport activity, sport characteristics, motives, culture.

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Biases in the simulation and the analysis of fractal processes

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Fractal processes have recently received a growing interest, especially in the domain of rehabilitation. More precisely, the evolution of fractality with aging and disease, suggesting a loss of complexity [1] has inspired a number of studies that tried, for example, to entrain patients with fractal rhythms [2]. This kind of studies requires relevant methods for generating fractal signals, and for assessing the fractality of the series produced by the participants. In the present work we engaged a cross-validation of three generation methods and three analysis methods. Our rationale is that biases that are revealed by the three analysis methods should be attributed to the generation method, and conversely biases that appear whatever the generation method should originate in the analysis method. We generated exact fractal series with (1) the Davies-Harte algorithm (DA, [3]), (2) the Spectral Synthesis Method (SSM, [4]), and (3) the ARFIMA synthesis method [5]. The series were analyzed by (1) the evenly spaced Detrended Fluctuation Analysis (DFA, [6]), (2) the Power Spectral Density method (PSD, [7]), and (3) ARFIMA modeling [8]. Results show that some methods of generation present systematic biases: DA presented a strong bias toward white noise in fBm series close to the $1/f$ boundary (i.e. from $\alpha = 1.01$ to $\alpha = 1.1$). SSM produced series with a larger variability around the expected exponent, as compared with other methods. Concerning the methods of analysis, DFA tended to systematically underestimate fBm series. In contrast, PSD yielded overestimates for fBm series. With DFA, the variability of estimates tended to increase as α increased, and reached unacceptable levels for fBm series. The highest levels of variability were produced by PSD. Finally, ARFIMA methods generated the best series, and provided the most accurate and less variable estimates.

Keywords: Complexity, Fractal processes, Exact Fractal generation, Time series analysis.

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Characterizing children cortical bones mechanically and by imagery then comparing with adults' bones

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Introduction. Mechanical characterization and imagery structure assess bone quality. The aim of this work is to provide anisotropic & multiscale characterization of children cortical bones properties then comparing with Adults' bones. **Methods.** The microindentation machine measures the elastic modulus & hardness of child bone at micro level. Resonance Ultrasound Spectroscopy (RUS) measures the anisotropic elasticity at the meso level and micro-CT scanner allows imagery analysis of the 3D reconstructed images by using Imorph and ImageJ. **Results and Discussion.** The Microindentation (micro level) is a work in progress. By using RUS (meso level), the elastic properties of adults' and children bones are proved to be isotropic transverse. Moreover, iMorph filter detects small pores at a resolution of less or equal to 10 µm. All experiments will be correlated later to provide the important parameters describing bone quality. As Future Perspectives, it is important to provide reference values for the quality of non-pathological child bone and a clinical diagnostic tool for child pathology bone.

Keywords: cortical bone, mechanical properties, resonant ultrasound spectroscopy, microindentation

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Reversals movements in the locomotor interception behavior

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Introduction: According to the Constant Bearing (CB) strategy, locomotor interception is dynamically controlled by nulling the rate of change in the target's bearing angle θ (i.e., by nulling $d\theta/dt$). However, targets crossing the agent's initial heading direction before being intercepted tend to evoke preliminary agent movement towards the initial target position rather than directly moving towards the future interception point [1]. Such reversals movements (RM) are not compatible with pure $d\theta/dt$ -nulling control [2]. Our goal was to study the influence of the initial eccentricity of a moving target on locomotor interception behavior. **Method:** Moving at constant speed through a virtual environment, participants ($n=9$) steered a driving simulator to intercept targets that could follow different rectilinear trajectories. Targets appeared straight ahead ("Center") or at 23° or 32° eccentricities ("Side") relative to the participant's initial heading direction. **Results:** While no RMs were observed in the Center conditions, the eccentric targets gave rise to up to 64% MR across all trials of a condition. Present in all participants' behaviors, RMs were significantly larger in amplitude for more eccentric initial target positions (Mann-Whitney Test: $Z = 3.64$, $p < 0.001$). **Discussion and conclusion:** The exclusive presence of RMs in the Side conditions and the fact that they were larger when initial target eccentricity was larger indicate that participants did not rely uniquely on $d\theta/dt$ as suggested by the CB strategy: the target bearing θ also played a role.

Keywords: locomotor interception, reversals movement, constant bearing strategy

References

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Dynamics of Approach and Avoidance Goals in Achievement Contexts

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Approach and avoidance goals have recently been conceptualized as two competing attractors, the landscape of which is determined by a control parameter, K , such as $K = (C \times Bs) - [Ts \times (1 - C)]$, with C as competence expectancies, Bs as benefit for the self, and Ts as threat for the self [1]. To test potential nonlinear transitions across approach and avoidance, we examined the effects of gradual variations of competence feedback within conditions of high or low activation of the self. Eighty-six sport sciences students were randomly assigned to the four experimental conditions of a 2×2 factorial design (Self activation: high vs. low \times Feedback series: increasing vs. decreasing). They carried out 11 blocks of 10 trials of a perceptivo-motor task which consisted of placing a computer's mouse pointer as accurately and as quickly as possible on a point of a map of France they deemed to be as close as possible from a previously announced city. Following each of the first 10 blocks, participants were provided with the (manipulated) feedback of performance regarding that block and answered items regarding the next block and measuring C , Bs , and Ts —which enable the calculation of K [2], as well as their intention to continue the task. Multivariate and univariate analyses of variance revealed significant effects involving Feedback, but not Self activation. For both K and Intention, changes over the blocks were more abrupt in the decreasing feedback condition than in the increasing feedback condition. Moreover, regressing K and Intention on time (blocks) with a curve estimation procedure showed significant quadratic and cubic trends for both variables in both increasing and decreasing feedback conditions. These findings bring a first support to the dynamical properties of approach and avoidance goals.

Keywords: dynamical systems, achievement goals, control parameter, nonlinearity

References

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TABLES RONDES

Parmi les différentes sessions proposées lors de la journée, les tables-rondes inviteront tout particulièrement à l'échange et à la discussion sur le thème « Sciences and I ». La discussion débutera par une brève présentation de l'intervenant et de son entreprise n'excédant pas 5 min.

Les tables rondes dureront 1H (3 fois 20 minutes) et seront organisées à la manière d'un « speed dating » par groupe. C'est donc par groupe (autant de groupes que d'intervenants afin de garantir les échanges) que les participants à la journée iront à la rencontre des intervenants dans l'objectif de découvrir leurs entreprises.

Le roulement des groupes lors du « speed dating » sera assuré par un modérateur extérieur afin de garantir la gestion du temps de parole des intervenants et des participants.

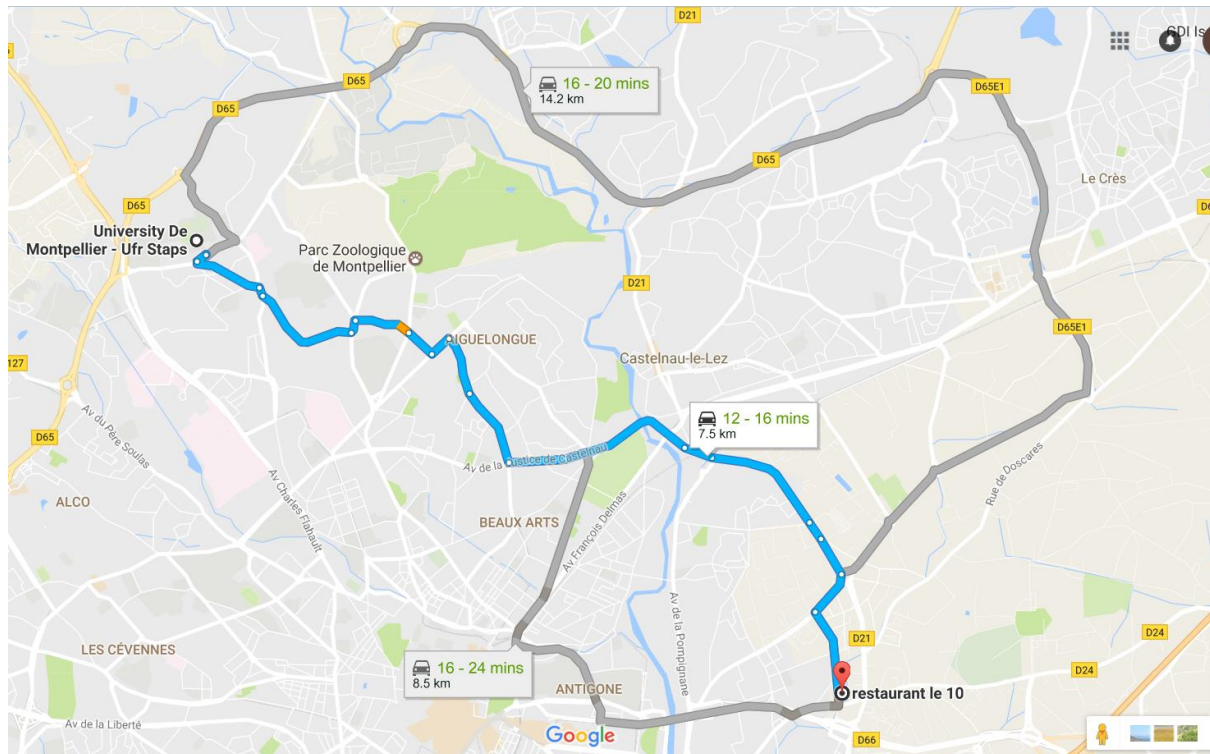
Cette année nous avons le plaisir d'accueillir aux tables rondes des représentants de Décathlon, NatauralPad, Walkoo, Akiani, du CNU, de l'IMT Mines Alès ainsi que notre invité M. Christophe Rodo.

Plan d'accès au restaurant "Le 10"

Restaurant Le 10

655 rue Alfred Nobel

34000 Montpellier



Un apéritif avec des petits fours vous sera proposé vers 20h00-20h30. Vers 21h-21h30 un buffet d'entrées froides et chaudes, suivies d'une plancha viande ou poisson. Enfin, buffet de desserts. Soft drink et vins.

Le restaurant se trouve à 12-20 minutes en voiture du lieu de la JED.



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