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Intersegmental body coordination during obstacle avoidance in a virtual environment

Marco Antônio Bühler[a,b,*], Anouk Lamontagne[a,b]
[a] *School of Physical & Occupational Therapy, McGill University, Montreal, QC, Canada*
[b] *Feil and Oberfeld Research Center, Jewish Rehabilitation Hospital, Research site of CRIR*
[*] *Corresponding author.*
Adresse e-mail : marco.buhler@mail.mcgill.ca (M.A. Bühler)

Introduction Postural coordination is essential for implementing efficient obstacle circumvention strategies during locomotion. While virtual environments (VEs) are increasingly used to replicate real-life conditions and safely assess or train patients on complex locomotor tasks, the extent to which coordination strategies in VEs differ from that observed in the physical environment (PE) remains to be elucidated.
Material and methods The objective was to estimate the extent to which coordination strategies in the VE differ from the PE. Healthy young participants ($n = 10$) were assessed while walking towards a target and avoiding pedestrians approaching from different directions (left, centre, right) in a VE vs. PE. The VE, identical in size and appearance to the PE, was viewed using a HTC VIVE head-mounted display (HMD). Centre of mass trajectory (CoMt), as well as head, thorax and pelvis yaw, were measured using a Vicon system.
Results In both environments, participants reoriented their body segments towards their heading direction during obstacle circumvention. In the PE, the reorientation sequence started with the head (2.94 ± 0.04 m from obstacle), followed by the trunk (2.74 ± 0.03 m), pelvis (2.71 ± 0.04 m) and CoMt (2.64 ± 0.04). In the VE, reorientation started with the pelvis (2.97 ± 0.03 m) and trunk (2.95 ± 0.03 m), followed by the head (2.79 ± 0.04 m) and CoMt (2.77 ± 0.04 m). Smaller maximum head reorientation ($\Delta = 1.72 \pm 0.67$; $P < 0.05$) was observed in the VE vs. PE.
Conclusion Head reorientation was smaller and delayed in the VE, which could be due to the characteristics of HMD and a need for longer visual fixation on the obstacle/target. These differences should be considered when using VR in locomotor rehabilitation.
Keywords Virtual reality; Obstacle avoidance; Postural coordination; Pedestrian

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Gaze behavior of healthy young individuals navigating in a community environment

Joshi Hayati[a,b,*], Archambault Philippe[a,b], Lamontagne Anouk[a,b]
[a] *School of Physical and Occupational therapy, McGill University, Montreal, Canada*
[b] *Feil and Oberfeld Research Centre, Jewish Rehabilitation Hospital research site of CRIR, Laval, Canada*
[*] *Corresponding author.*
Adresse e-mail : hayati.joshi@mail.mcgill.ca (J. Hayati)

Introduction Independent community walking relies heavily on the sense of vision and involves locomotor adaptations (i.e. changes in speed and direction) that are essential to avoid hazards in the environment (e.g. obstacles). In this project, we are examining gaze behavior and body kinematics as healthy individuals ambulate and avoid other pedestrians in a living lab representing a community environment. To characterize gaze behavior and kinematic strategies during obstacle circumvention while walking in a community environment.
Material and methods Twelve healthy young individuals (18—29 yrs) were assessed while walking towards a target with different exposures to static and moving obstacles in Alexis Nihon Mall in Montreal. Kinematics and temporal distance factors were assessed with wearable sensors (APDM) while gaze behavior was recorded with an eye-tracker (Tobii Pro 2).
Results Preliminary data analysis ($n = 3$) indicate that looming vs. receding pedestrians were looked at a closer distance and less frequently, for shorter duration but they yield higher relative gaze fixation duration. Also, right vs. left pedestrians were looked at a further distance.
Conclusion Results suggest that looming pedestrians, while present for shorter duration, impose a greater risk of collision. Results further suggest a possible lateralization of attention and maintenance of personal space during collision avoidance. Collectively, present findings will help better understand how visual information is used for obstacle negotiation in a community environment and will serve as a basis for comparison to understand community walking challenges experienced by older adults and individuals with a physical disability.
Keywords Gaze behavior; Kinematics; Living lab; Locomotion; Rehabilitation

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L'influence de la fonction vestibulaire sur le bénéfice postural lors d'une stimulation galvanique chez les personnes âgées

Mujda Nooristani[a,b,*], Maxime Maheu[a,b], François Champoux[a,b]
[a] *École d'orthophonie et d'audiologie, université de Montréal, Montréal, Canada*
[b] *Centre de recherche, institut universitaire de gériatrie de Montréal, Montréal, Canada*
[*] *Auteur correspondant.*
Adresse e-mail : mujda.nooristani@umontreal.ca (M. Nooristani)

Introduction Il est bien connu que la fonction vestibulaire se détériore avec l'âge. La stimulation vestibulaire galvanique (SVG) est une technique visant à améliorer la fonction vestibulaire par un courant électrique appliqué au niveau des mastoïdes. Elle a un effet bénéfique lors d'une tâche de contrôle de la posture chez les personnes âgées. Des études antérieures suggèrent que l'amélioration de la performance induite par une stimulation galvanique au niveau cortical est supérieure chez les sujets présentant une hypofonction. L'objectif de cette étude est d'examiner les effets de la SVG chez les personnes âgées ayant une fonction vestibulaire normale et de comparer leurs résultats à celles ayant une hypofonction vestibulaire.
Matériel et méthode Sept personnes âgées présentant une fonction vestibulaire normale et six ayant une hypofonction vestibulaire ont reçu aléatoirement une stimulation galvanique ou une stimulation placebo. Une tâche de contrôle postural statique sur un coussin en maintenant les yeux fermés a été réalisée pendant 30 secondes à deux reprises avant et durant la stimulation. Les paramètres de contrôle postural analysés étaient la vitesse de déplacement et le déplacement total du centre de pression (CoP).
Résultats Les données ont révélé une tendance démontrant une amélioration de la vitesse de déplacement et du déplacement total durant la SVG dans le groupe de personnes âgées présentant une hypofonction vestibulaire.