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Presentation Title:

Locomotor Coordination, Visual Perception and Head Stability

Abstract:

Perception and action are coupled such that information from the perceptual system is related to the dynamics of action in order to regulate behavior adaptively. Using locomotion as a model of a cyclic behavior, this coupling involves a continuous relationship between the actor's perception of the environment and the necessary adjustments of the body that ultimately result in a stable pattern of behavior. Studies have shown that stable head acceleration, as needed for accurate information pick up, appears across a variety of locomotor conditions where gait parameters are changed; examples include greater shock attenuation at the head with increased gait speed, lower stride frequency and longer stride length during walking and running. Evidence indicates that the modulation of shock occurs both passively and actively though changes in segment geometry and/or greater knee flexion. While these movements serve to stabilize head motion and support visual information pick up in response to altered gait parameters, the inverse, how the body adapts to meet the different degrees of head stability demands under

different visual task constraints is less clear. The purpose of this presentation is to illustrate how individuals relate visual perception to rhythmic locomotor coordination and shock attenuation patterns in conditions during which foot–ground collisions and visual task demands are altered. We review the findings of studies conducted to illustrate how humans change their behavior to maintain head stability during walking and running with and without various degrees of visual challenge from the environment. We will demonstrate that the human body adapts specific segment/joint configurations and coordination patterns to maintain head stability, both in the lower extremity and upper body segments, together with an increase in coordinative variability. These results indicate that in human locomotion, under different locomotor and visual task demands, systematic adaptations occur in the rhythmic coupling between the perceptual and movement systems.

Short CV:

Dr. Richard E.A. van Emmerik is a Professor and Chair in the Department of Kinesiology at the University of Massachusetts Amherst, USA. He received his undergraduate degree in Movement Science from the Vrije Universiteit in Amsterdam, the Netherlands, and his Ph.D. degree in Kinesiology from the University of Illinois at Urbana-Champaign, in the USA. In his research, he applies principles from complex and nonlinear dynamical systems to the study of posture and locomotion, with a focus on coordinative processes underlying expert performance as well as movement disorders. The research in his laboratory is integrative and focuses on the interaction between mechanical, neural and perceptual factors underlying the control of posture and gait, with applications to aging, rehabilitation, and optimal performance. His research on coordination addresses both expert and impaired movement and the role of adaption. The work on movement disability examines the role of coordinative variability as it relates to postural and gait stability and adaptability, while his research with the Department of Defense is aimed at establishing a better understanding of how head-mounted loads impact soldier performance and perception under various environmental

conditions and challenges. He is a member of the Royal Dutch Academy of Arts and Sciences, the American National Academy of Kinesiology (NAK), and serves on the editorial boards for Human Movement Science, Motor Control, Kinesiology Review, and the Brazilian Journal of Motor Behavior.