PGTA Project Proposal

Discipline:	Biomechanics and Motor Control
Project Title:	The importance of sensory and motor errors in the control of human balance
Supervisory Team:	Dr Glen Blenkinsop Dr Michael Hiley Dr Matthew Pain
Summary of proposed project:	The control of movement and posture requires the detection of the environment through various sensory receptors throughout the body. The minimum intensity of a stimulus that is required to produce an action potential from a sensory receptor dictates the sensory threshold, below which movement goes undetected. Sensory saturation refers to the maximum intensity of a stimulus that produces a response from a sensory receptor, above which further changes in movement cannot be determined. In addition, the non-linear nature of these systems results in small errors in the actual movement stimulating the sensory receptor and the movement perceived from the transmitted signals. Collectively, the vast array of sensory receptors, of varying types, creates an overdetermined system that enhance the dynamic range of the sensory system, increasing the range of intensities that can be detected as movement. However, this over-determined system can also result in sensory conflict, leading to further errors in movement detection. This multitude of sensory information must be interpreted by the central nervous system to produce an appropriate motor response. Any errors within this motor response will lead to a deviation away from the desired response, resulting in the need for further corrections from the control system to maintain balance. Possible errors include: an inability of the neuromuscular system to produce a large enough change in the activation of muscles (activation dynamics); non-linearities in the response of a muscle to the same level of activation (force-length-velocity relationships); and compliance in the musculoskeletal system (i.e. tendons or other elastic components). The proposed project will use a combination of EMG, kinematic (motion capture) and kinetic (force plates) data collection in conjunction with a Motek CAREN (Computer Assisted Rehabilitation ENvironment) system and dynamometry to administer external perturbations and/or generate sensory conflicts. Experimental results will be examined to predict sensory errors to determine sensory thresholds and sensory acuity, which can subsequently be entered into a postural control simulation model to replicate human balance.
Required skills, experience, and/or education:	Applicants should have at least a 2:1 Honours degree (or equivalent) in sport science (with a large component of biomechanics), physics, engineering, mathematics or a related subject. A relevant Master's degree and/or experience in one or more of the following will be an advantage: computer simulation modelling (OpenSim, AnyBody, Visual3D, etc.), 3D motion analysis (Vicon, Qualisys, etc.), MATLAB or similar.
Link to School research theme:	Sport Performance Lifestyle for Health and Wellbeing