Proposed Director of Studies: Prof Suvo Mitra

Project Title:

Effects of ageing on the interaction between action planning and balance performance

Expected REF Unit of Assessment: A04 Psychology

Summary of project:

In everyday activities, higher level cognitive functions involving working memory, spatial navigation, and visual guidance of action tend occur within the context of large-scale body coordination tasks such as maintaining standing posture, orienting, or locomoting. Performance in both cognitive and physical coordination tasks slows and deteriorates in old age. Recent research has found that higher cognitive function and body coordination tasks can mutually interfere, particularly as we age, and cognitive load is a recognized risk factor in falling in old age. In view of an aging population and increasing life expectancy, there is an urgent need to understand how even well practiced, and seemingly automatic, coordinations such as standing and walking appear to share information-processing resources with high level mental tasks.

A mental activity that occurs frequently in daily life is thinking about our own or others' actions. Thinking about movements (without executing them) is termed motor imagery, and it is a key aspect of action planning. Even though thinking about movements does not mechanically affect the body, a wealth of evidence shows that imagining actions activates a range of both central and peripheral neural systems that are normally involved in the control of movement execution. In some cases, motor imagery is accompanied by muscle activation that is detectable using electromyography. A working hypothesis is that motor imagery involves an active simulation of the movement task, with a system of inhibition preventing movements from occurring. However, if motor imagery activates the motor execution system, it has the potential to interfere with other ongoing motor coordinations such as balancing (as in standing), walking, climbing stairs, or driving. Indeed, recent work, including in our lab, has been finding that the body generates autonomic responses and postural adjustments during motor imagery tasks, and that at least the latter are linked to the specific demands of the action being imagined. The implication is that the postural and autonomic component of imagined actions is not as effectively inhibited as the action itself. We also have evidence that the postural response during motor imagery can change in old age, whereby older people tend to restrict their body sway as though they were bracing against a perturbation.

This project will study the impact of manual motor imagery tasks (e.g., reaching, grasping, lifting) on concurrent standing, walking, and sit-to-stand coordinations in healthy young and older adults. The experiments will use motion capture, electromyography, heart rate and skin conductance measures to build a comprehensive performance profile of the manual tasks when they are executed and imagined. It will then investigate the interactive effects that occur when these tasks are performed alongside a whole-body coordination.

There is evidence that, apart from a gradual decline in strength and speed of neural signaling, old age is associated with an increasing discrepancy between the planning and performance of motor tasks. For example, young people show close correspondence between their imagined and executed movement times, whereas older people tend to imagine faster (or in some cases slower) movements than they actually execute. This suggests that ageing reduces the accuracy of the internal models that are used to plan movements (for imagery or execution). Across its experiments, this project will test the hypothesis that this loss of internal model precision is linked to the type and level of postural response (i.e., self-generated perturbation) that occurs during motor imagery. In addition to

the experiments, the project will also collect subjective measures of task competence and balance confidence in these task settings and look for indications that this loss of internal model precision is an important element in judgements about the risk of activities in old age.

The successful candidate will have the opportunity to train on, and work with, Codamotion motion tracking, Delsys Trigno wireless electromyography, and AMTI force measurement in a state-of-the-art laboratory suite. They will be able to access well-maintained young and older adult panels to recruit participants, and depending upon the candidate's background and interests, there is a possibility to tailor the internal model correspondence aspect of the project to use TMS or EEG techniques. A Magstim stimulator with ANT Visor2 neuronavigation, and a 128-channel Biosemi system both supported in adjacent laboratories).

Specific qualifications/subject areas required of the applicants for this project (e.g. First degree in specific subject area):

UK 1st Class / 2.1 Bachelor's degree (or UK equivalent according to NARIC) in psychology, neuroscience or sport and exercise would be preferred.

Application deadline: **5pm (UK time) on 26th May 2017**

Funding notes

This studentship competition is open to applicants who wish to study for a PhD on a full-time basis only. The studentship will pay UK/EU fees (currently set at £4,195 for 2017/18 and are revised annually) and provide a maintenance stipend linked to the RCUK rate (this is revised annually and is currently £14,553 for academic year 2017/18) for up to three years*. The studentships will be expected to commence in 2017.
*Applications from non-EU students are welcome, but a successful non-EU candidate would be responsible for paying the difference between non-EU and UK/EU fees. (Fees for 2017/18 are £12,900 for non-EU students and £4,195 for UK/EU students)