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UCT uses modified MRI scanner to measure brain waves of cyclists in the saddle

Researchers at the University of Cape Town have found a way to measure the brain activity of a cyclist who is operating at racing speed, using a specially modified MRI scanner that holds the subject's head still while the legs are pedalling.

The project is breaking ground for the study of the brain during physical activity, and sets the tone for a string of possible new intervention studies to follow up on this pilot work, according to Dr Elske Schabort, a postdoctoral fellow at the UCT/Medical Research Council Research Unit for Exercise Science and Sports Medicine (ESSM).

Schabort said: "Because of the difficulty of the project, technique, equipment and methodology, limited information is available in this area of exercise science research. The opportunity to be among the first to initiate such novel investigations will allow great progress in our work to try to understand and describe the involvement of brain and central nervous system during exercise and performance regulation."

The project was initiated by Eduardo Fontes, a doctoral student from the University of Campinas (UNICAMP) in São Paulo, Brazil. He came to the ESSM recently to try out a modified scanner bed he and his father had designed. It allows a cyclist to lie flat on his or her back while being able to pump furiously at a set of pedals connected to a cycling ergometer. The cyclist's head is held stock-still in a helmet fixed to the bed of the scanner. (Watch a video of the gadget at www.youtube.com/watch?v=L8SghDfyo-8.)

The machine allows researchers to take an MRI scan of the cyclist completing a standard VO_2 max (or maximal oxygen consumption) test. This test measures the maximum amount of oxygen that a person's body can transport and use during a bout of exercise where intensity is gradually increased over time.

Fontes brought his research to UCT after hearing of the work of Professor Tim Noakes, the Director of ESSM, on the relation between the brain and sports performance, and how (and which) cerebral areas control exercise.

To get cyclists used to the head restraints and the sensation of cycling while supine within the claustrophobic confines of an MRI scanner, Fontes called on the help of Charles Harris, the chief technical officer in UCT's Department of Human Biology. In his workshop Harris constructed a mock-up of the MRI bed and scanner, and made sure the final cycling apparatus was scanner-friendly (for example, that it contained no metal).

Fontes ran the full tests and scans in April 2011 with seven well-trained, competitive cyclists. It took the cyclists a session or two to get used to the unusual set-up of the simulator, he said. "The first impression when they see it is, oh man, I won't make this," said Fontes. "But after we improved their comfort – their head and their positioning – they're fine."

The prep work with the cyclists on the simulator – including full VO_2 max tests – took place at the ESSM facilities at the Sports Science Institute of South Africa in Newlands, while the MRI scans were done at the Cape Universities Brain Imaging Centre on Stellenbosch University's Tygerberg campus.

Now back in Brazil, Fontes is starting to analyse the data. He and a team of international collaborators at ESSM and UNICAMP will calculate the specific demands of the atypical cycling position, and then cross-check that with what they find on the scans. The first results should be out early next year, said Fontes.

The initial findings suggest that the results from the simulator and MRI scans were very evenly matched – confirmation that the simulator did its job.

ENDS

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