About the SyMoN facilities

SyMoN comprises a number of specialised labs including Action dynamics, Active Touch, Transcranial Magnetic Stimulation (TMS), Posture and balance and a Technical Project Area.

Action Dynamics Lab

The **Action Dynamics Lab** is equipped with 3-camera motion tracking system (Qualisys Pro Reflex), 2 Phantom 1.5 force feedback systems (Sensable Technologies), 4 6-df load cells (ATI). There are also a number of single axis load cells (Novatech) for measuring impact forces, goniometers (Penny and Giles) for measuring joint angle, and accelerometers (Entran) for measuring limb kinematics.

The SyMoN Active Touch lab is equipped with Reach In workstation (haptic force feedback with co-located stereo vision) and a 4x5 element tactile array.

The Transcranial Magnetic Stimulation (TMS) Lab

The **TMS Lab** houses a Magstim Stimulator, complete with figure-of-8 coil, and boosters for rapid-train stimulation. A Brainsight system is used to guide the coil over the cortical areas to be stimulated. It comprises a pair of infra-red cameras connected to a Powermac G4. With the participant's MRI scan pre-loaded in the G4, reflective markers on the TMS coil and on the participant allow accurate positioning of the coil over the cortex. An Apple iBook is used with Psyscope software to create experiments with display of images and responses recorded on a CMU button box giving millisecond timing accuracy.

Posture and Balance Lab

Equipment in the SyMoN **Posture and Balance Lab** includes two force plates (Bertec) for measuring ground reaction forces and torques mounted on tracks that allow them to be placed side by side (for studies of sit-to-stand or standing) or diagonally (for gait studies).

A 12-camera motion tracking system (Qualisys Oqus) allows limb motions to be recorded. Inverse dynamics calculations allow the recovery of joint torques from the segment motions and ground reaction forces.

There is a 2-axis force-servo actuator system (Linear Thrust) for delivering perturbations to balance. The response to perturbation can be assessed in terms of the force plate recordings and muscle activity patterns (CED surface EMG).

Participants whose balance is unsteady may wear a harness system mounted on overhead tracks (Arjo) Outside the lab inertial wireless trackers (APDM Opal) are used to track multisegmental movements of one or more participants in activities such as locomotion. Software analysis tools include Qualisys Track Manager, C-Motion and custom applications written in Matlab, LabView.

Research in the SyMoN Posture and Balance Lab

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Cubicle 8

Cubicle 8 is home to the multi-sensory timing lab. The equipment in the room consists of an adapted version of MatTAP which is able to output three simultaneous metronomes in different sensory modalities: audio, visual and tactile. The visual metronome consists of an array of dual-coloured LEDs, while the tactile stimuli are presented via up to eight small actuators to the finger tips allowing both temporal and spatial perturbations. This allows us to investigate movement synchronisation in a multi-sensory environment.

Current research is investigating how we integrate multi-sensory information and whether that improves our synchronisation accuracy. In particular, we are examining whether the results fit to the optimal model of Maximum Likelihood Estimation (MLE). In addition, we are looking at improved metronome designs which incorporate extra visual information allowing musicians to perform to a more accurate tempo.

Technical Project Area

The SyMoN **Technical Project Area** provides design and build services for SyMoN research. It houses tools and test equipment required for the construction, modification and maintenance of the labs' instrumentation, PCs and other electronic systems. The Technical Project Area inventory includes an CRO, multimeters, cabling/connectors and large stock of common components.

Supplemental instrumentation is provide by a PC equipped with multichannel data acquisition hardware. This also doubles as a platform for the development of control software and other custom applications and is therefore equipped with a number of software development environments.

Kitchen Lab

A purpose built kitchen affords motion analysis of activities of daily living centred around preparing a snack, making a hot drink, or washing up at a height adjustable counter. Four Qualisys Oqus cameras supplemented by Kinect systems give motion tracking information supplemented by instrumented modules fitted to utensils and developed in the University's School of Electronic Electrical and Computer Engineering.

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