Overview of optical BCI research at NUI Maynooth

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Introduction:

A brain-computer interface (BCI) is a device that provides a user with an alternative means of interactive communication, rather than the usual modes via physical gestures/speech. Thus it acts as a neural prosthesis bypassing the normal output pathways of the brain, i.e. spinal cord and periphery cascade. An optical BCI uses optical means of determining the user's mental intent, e.g. to turn on a light switch, by spectroscopic analysis of the intact brain.

Methods:

The localised oxygen content of brain tissue determines the colour of that tissue sample. In the event of a specific mental command by the user, e.g. mental arithmetic, focal cortical brain tissue changes oxygenation status and thus colour. During this event, spectroscopic analysis indicates a dominant increase in oxyhaemoglobin and a decrease in deoxyhaemoglobin. These are measured using optical sources and detectors placed on the head in close proximity, whereby the backscattered light that has travelled through the tissue carries information about its' oxygenation.

Results/Conclusions:

The group's recent publications have shown that the application of the multi-channel optical BCI extends to stroke rehabilitation. The user could gain real-time insight into the improving state of the affected brain tissue via feedback of the localised oxygenation dynamics.