BrainTrain

Taking imaging into the therapeutic domain: **Self-regulation of brain systems for mental disorders**

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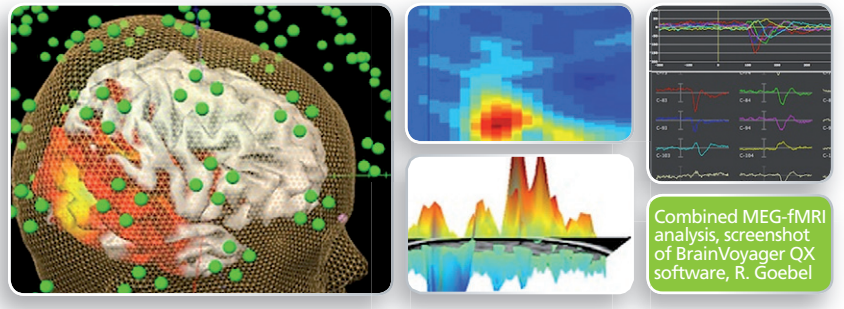
Context

Advances in neuroimaging have led to a better knowledge of both mental dysfunction and potential compensatory mechanisms in patients. Major nodes of disordered neural networks are in deep regions of the brain, which makes them difficult to access by electroencephalography or transcranial stimulation. Neuroimaging techniques are therefore essential for the development of non-invasive neuromodulation techniques for mental and behavioural disorders.

Real-time functional magnetic resonance imaging (fMRI) uses magnetic resonance imaging to measure brain activity, by detecting associated changes in blood flow which increases with neuronal activation.
fMRI can be used for on-line-monitoring of brain function as well as for self-modulation of neural processes via interactive training. With the **neurofeedback** procedure, patients learn control over brain activity using real-time signals from their own brain.



Combined MEG-fMRI analysis, screenshot of BrainVoyager QX software, R. Goebel

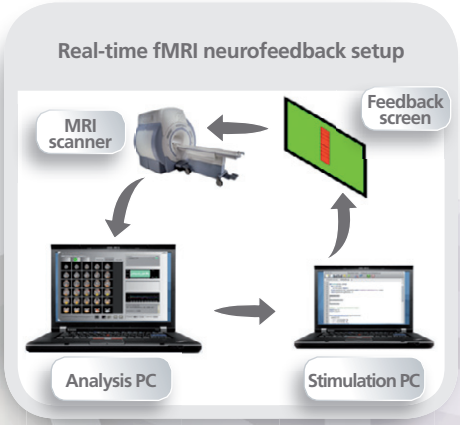
Through the development of fMRI-based neurofeedback techniques over the last decade, it is now possible to train patients in the self-regulation of the disordered networks with the aim of obtaining clinical benefits: improve diagnosis, restore function, alleviate symptoms and promote resilience.

Huge clinical needs for mechanism-driven therapies in psychiatry and clinical psychology

Neuroimaging techniques can be transferred to the diagnostic, therapeutic and preventive domains for a range of psychiatric and neurological disorders.

Objectives

BRAINTRAIN will improve and adapt the methods of real-time fMRI neurofeedback (fMRI-NF) for clinical use, including the combination with electroencephalography (EEG) and the development of standardised procedures for the mapping of brain networks that can be targeted with neurofeedback.



Its core component will be the exploration of the efficacy of fMRI-NF in selected mental and neurodevelopmental disorders that involve motivational, emotional and social neural systems. The ultimate goals of **BRAINTRAIN** are therefore to:

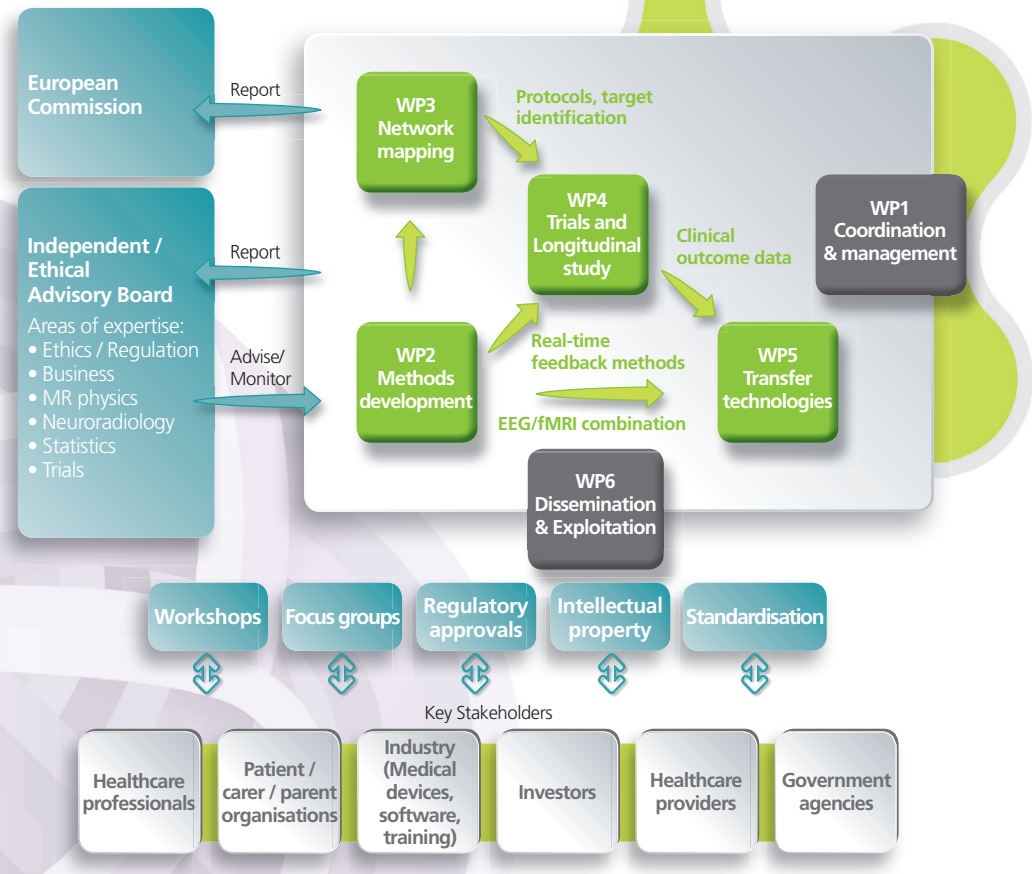
- Develop new or optimize existing imaging technologies,
- Validate their application as a therapeutic tool for mental and behavioural disorders by integrating imaging data with complementary knowledge from bioinformatics and clinical data,
- Facilitate the diagnosis of mental disorders at the pre-symptomatic stage or early during development,
- Better measure disease progression,
- Develop transfer technologies for fMRI-NF through EEG and serious games.

BRAINTRAIN is innovative in the development of new real-time imaging technologies including new sequences, image reconstruction methods and data analysis software. This will also be the first clinical testing of fMRI-NF in a set of disorders with extraordinary socioeconomic and public health impact.

Strategy

The **BRAINTRAIN** project has three main components:

- the development and refinement of methods for the real-time analysis and feedback of fMRI data and combination with other imaging modalities (WP2),
- the adaptation of fMRI mapping techniques to localise disease-relevant networks and development of protocols for their self-regulation through neurofeedback (WP3),



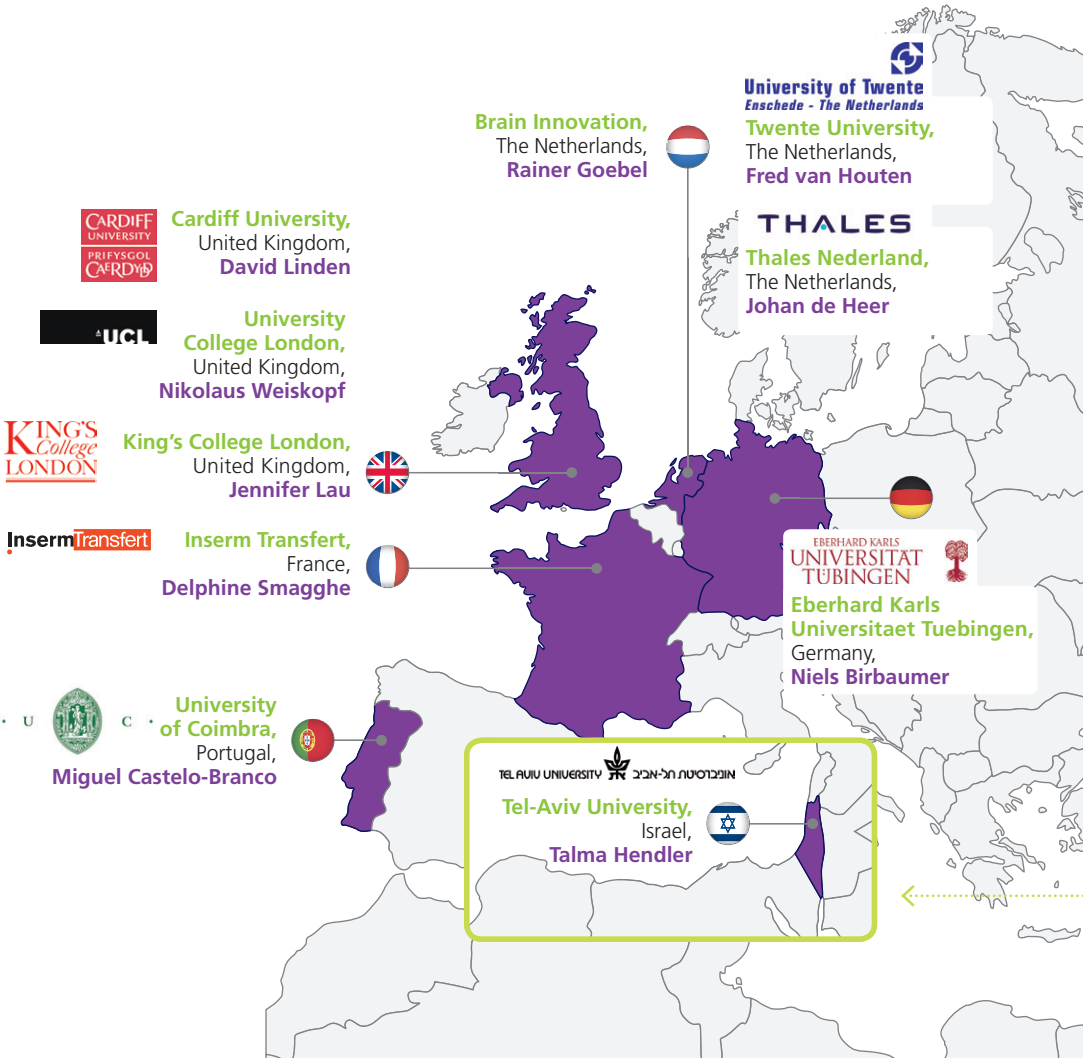
- the assessment of feasibility and clinical effects in several mental, metabolic and developmental disorders (autism spectrum disorders, alcohol addiction, post-traumatic stress disorder, childhood anxiety disorders, binge-eating disorder, obesity, depression) (WP4).

The consortium will also explore the potential transfer of imaging feed-back training into everyday settings through ambulatory and assistive technologies such as electroencephalography and near infrared-spectroscopy (NIRS) and gaming (WP5).

Finally **BRAINTRAIN** will engage with potential users of these technologies through several workshops, liaise with regulatory authorities and disseminate findings to the academic and user communities (WP6).

Partners

BRAINTRAIN is a four year European project (Collaborative Research Project), which started in November 2013 and is coordinated by Cardiff University (Professor David Linden, Wales, UK). Our consortium brings together 10 complementary partners, including 7 academic research institutions, one small/medium sized enterprise, a larger industrial partner and a technology transfer/management company. The partners are based in six countries (United Kingdom, France, Germany, Israel, Portugal and the Netherlands). The project is supported by the European Commission under the Health Priority of the 7th Framework Programme.



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