

Control and self-control of the brain



Cardiff University, Schools of Medicine and Psychology

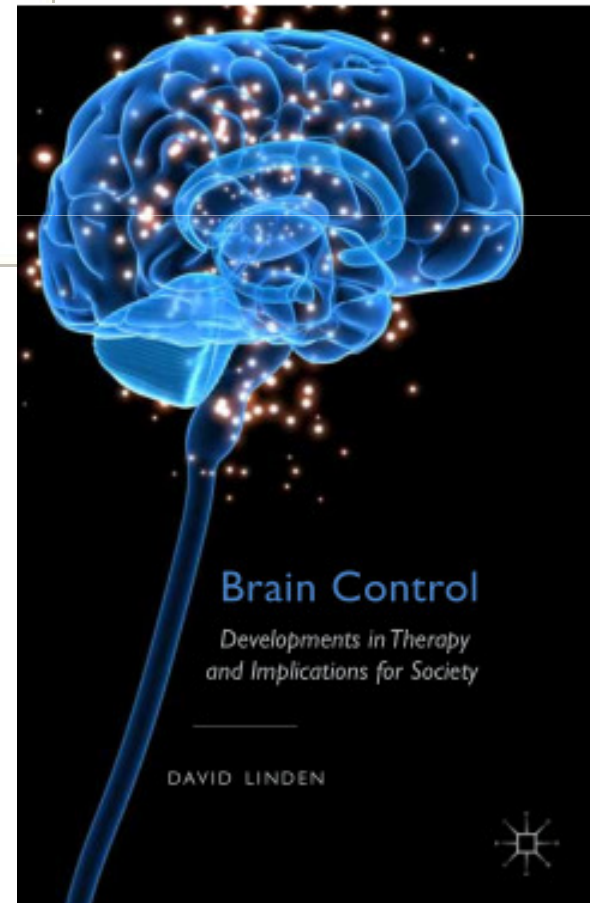
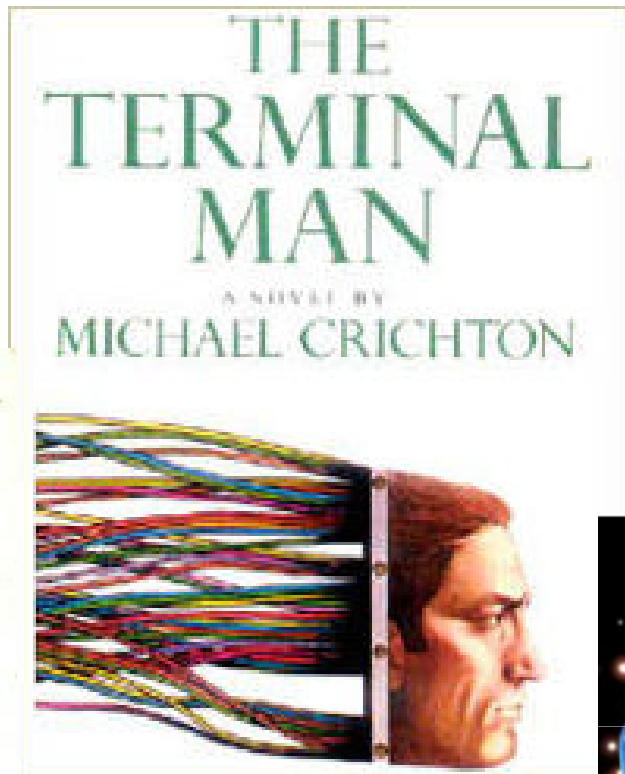
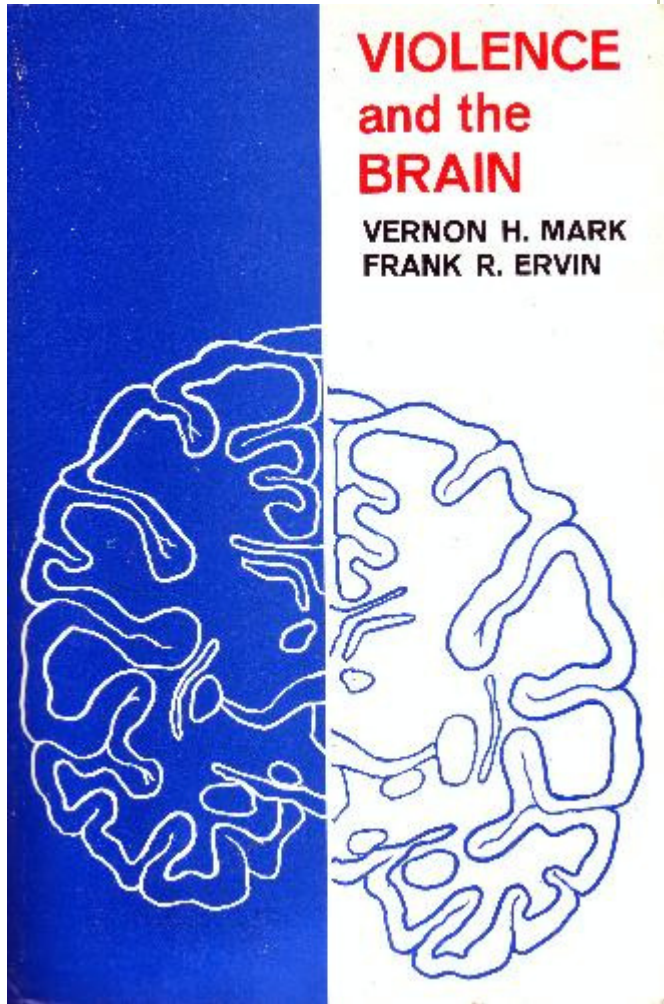
David Linden



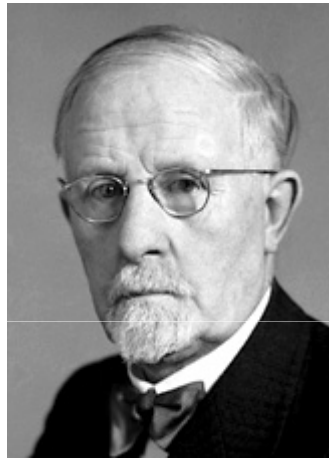
Welsh Neuropsychiatry Service



Delgado, "Physical control of the mind", 1969



Nobel Prize in Physiology or Medicine, 1949



Walter Hess

1881-1973

for his discovery of the functional organization of the interbrain as a coordinator of the activities of the internal organs

(www.nobelprize.org)



Egas Moniz

1875-1955

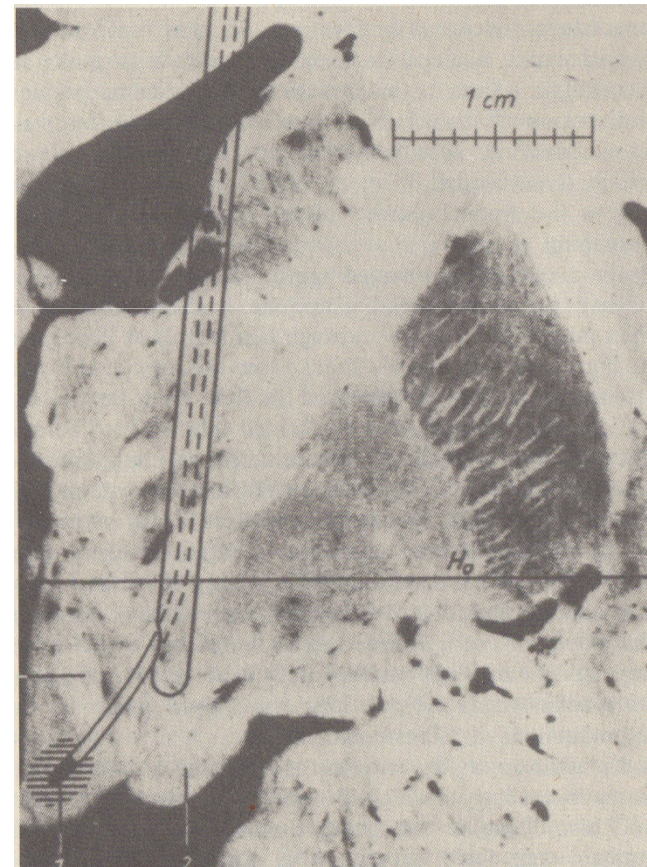
for his discovery of the therapeutic value of leucotomy in certain psychoses

Freeman (1972)

- "If the lobotomy has reduced the preoccupation with the self, the fantasy life and the introversion... the scene is set for improved social achievement. In many instances the underlying schizophrenic process may continue but the emotional impact of ideas concerning the self and the environment is reduced. Such patients are still schizophrenic but might be termed successful schizophrenics, endowed with adequate ambition, foresight, tact, and other qualities that make for adequate social existence."

Hypothalamotomy in sexual offenders

- Based on animal experiments where hypothalamotomy reversed Kluever-Bucy syndrome
- Appr. 80 cases in 1960s and 1970s, mainly in Germany

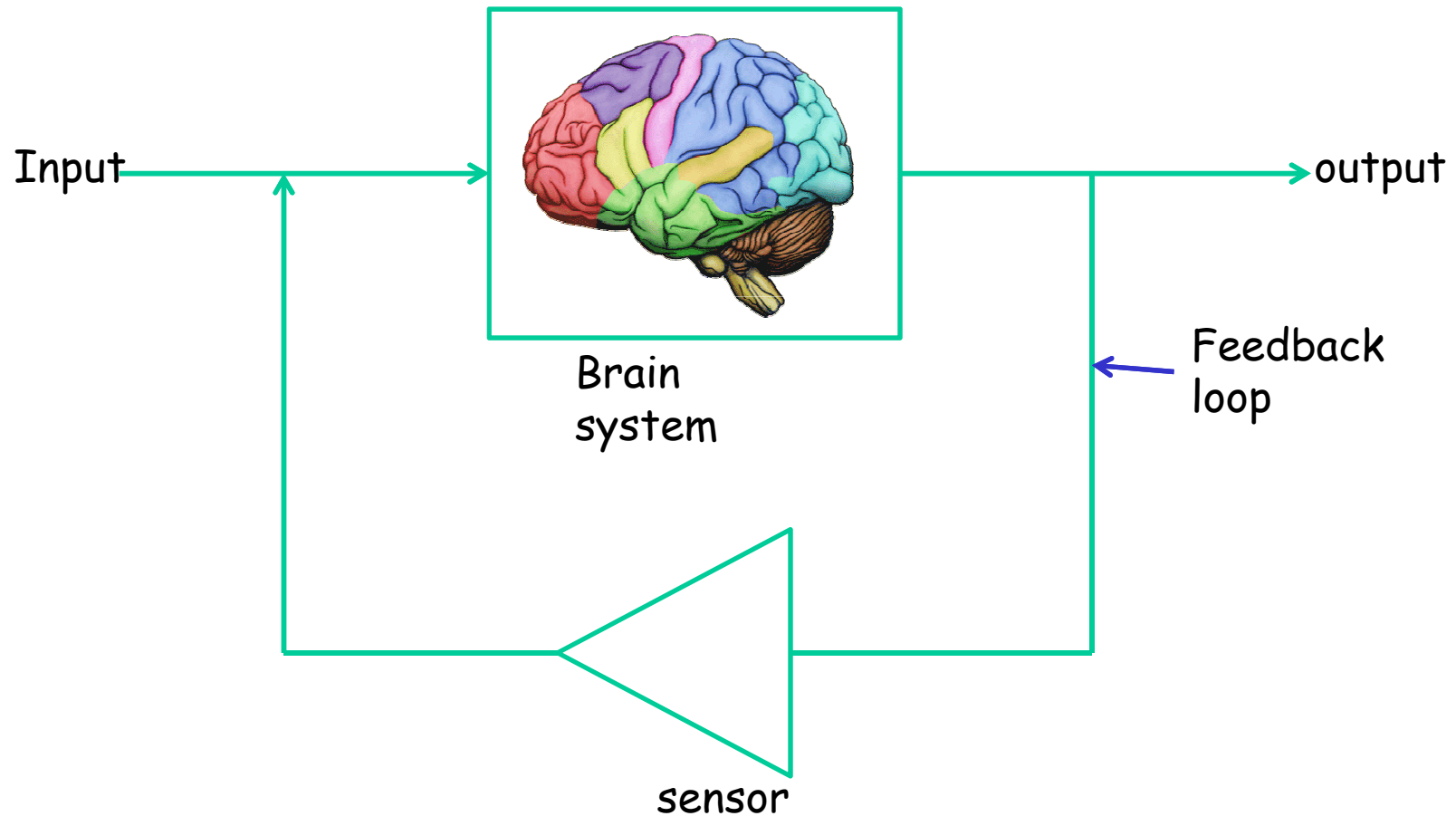


Roeder, Orthner, Mueller, 1972

How effective was hypothalamotomy? (28 cases from Hamburg - 1970s)

- 9 had history of paedophilia, others had suffered from other paraphilias (exhibitionism, fetishism) or had committed rape of women or girls.
- All but 3 of them had been convicted of mostly sexual offences.
- 24 out of the 28 patients experienced a considerable and lasting reduction of sexual drive
- 23 reported a clear reduction of the stimulating effect of sexual cues
- 5 had further convictions, including 1 homicide
- The programme was stopped around that time

Self control of the brain



Developmental Clinical Study: Neurofeedback in depression

Neurofeedback with fMRI

- Modulation of brain activity in a particular area by the subject herself
- Training based on real-time feedback of fMRI time course

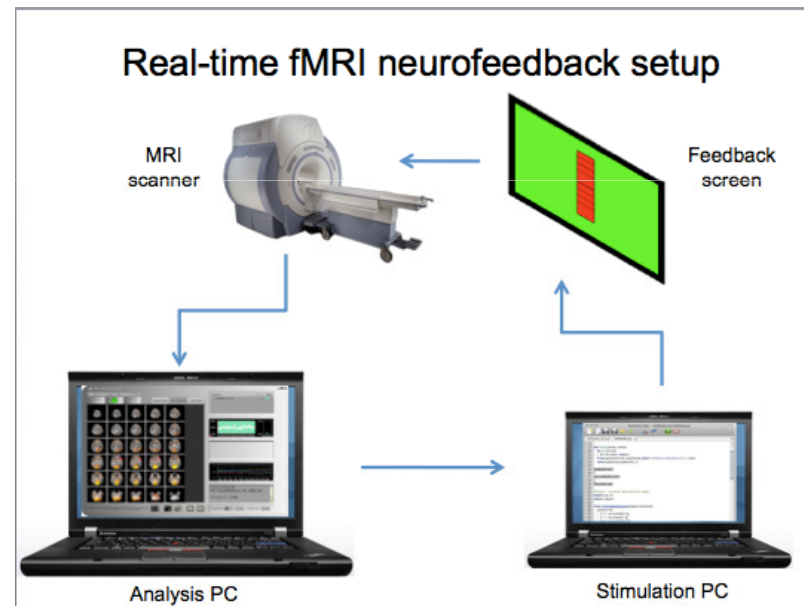
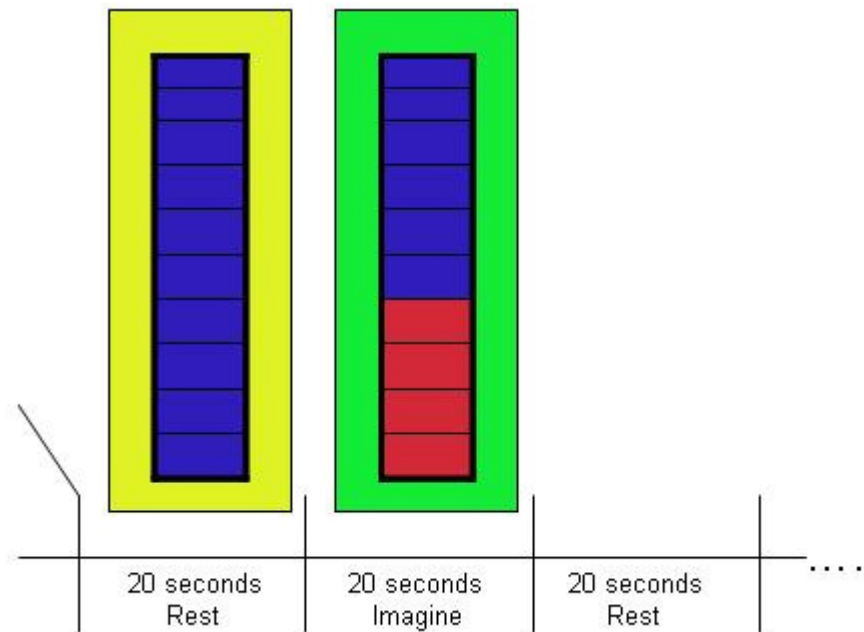
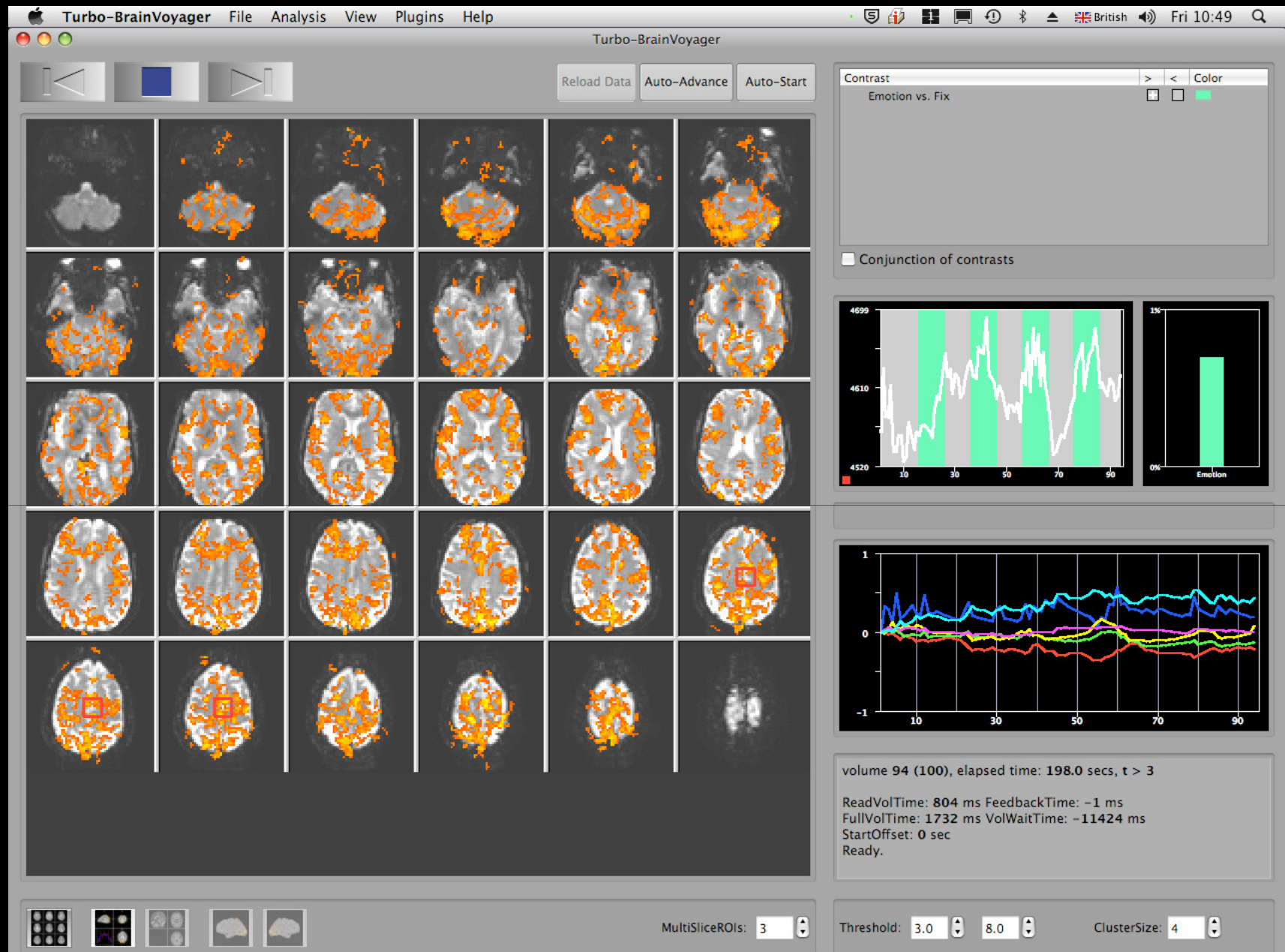


Figure courtesy of Isabelle Habes

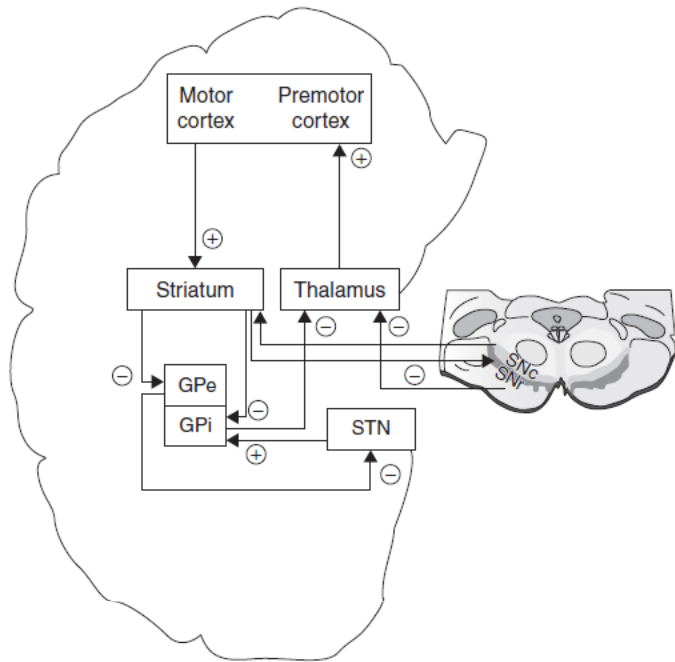
Neurofeedback protocol



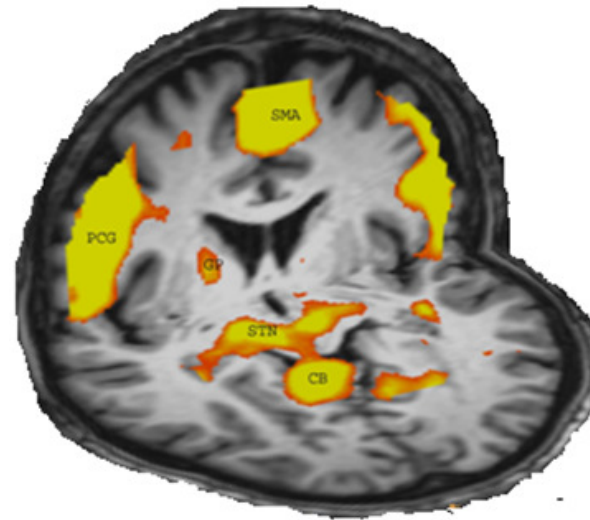


Subramanian et al., Movement Disorder Society Conference, 2013

Motor networks of PD



Activation during NF



Clinical effects: UPDRS scores

Linden, The Biology of Psychological Disorders, 2012

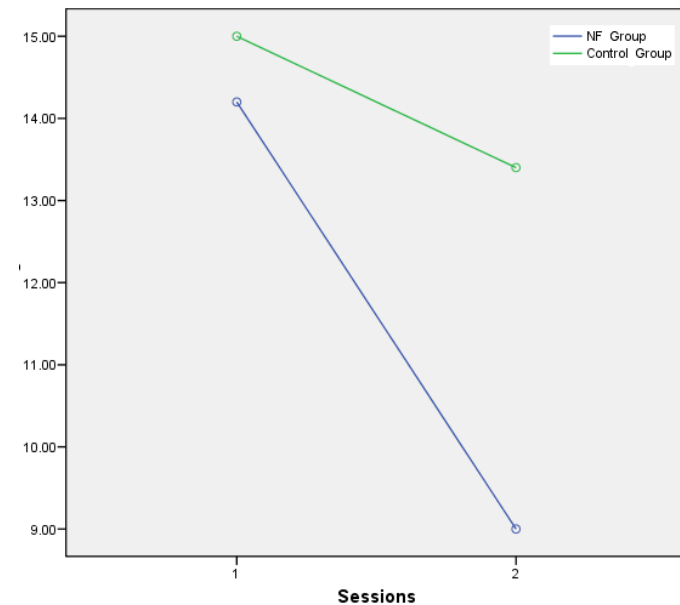
The Journal of Neuroscience, November 3, 2011 • 31(45):16309–16317 • 16309

Neurobiology of Disease

Real-Time Functional Magnetic Resonance Imaging Neurofeedback for Treatment of Parkinson's Disease

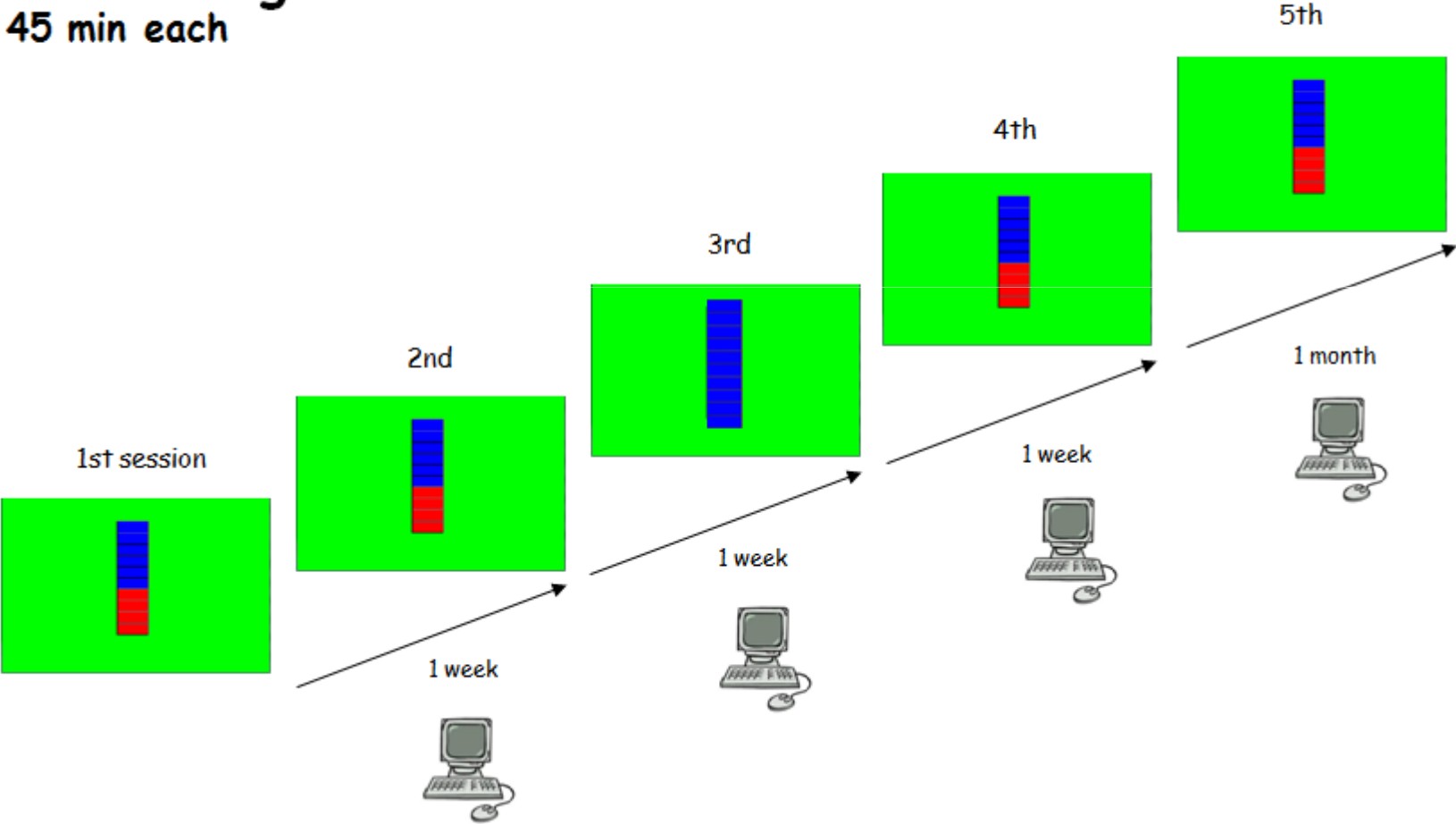
Leena Subramanian,^{1,2} John V. Hindle,¹ Stephen Johnston,³ Mark V. Roberts,¹ Masud Husain,⁴ Rainer Goebel,⁵ and David Linden^{1,2,3}

¹Schools of Psychology and Medical Sciences, Bangor University, Bangor LL57 2AS, United Kingdom, ²Schools of Medicine and Psychology, Cardiff University, Cardiff CF14 4XN, United Kingdom, ³School of Social Sciences, Brunel University, Uxbridge UB8 3PH, United Kingdom, ⁴Institute of Cognitive Neuroscience, University College London, London WC1N 3AR, United Kingdom, and ⁵Department of Cognitive Neuroscience, Maastricht University, 6200 MD Maastricht, The Netherlands



RCT: Neurofeedback in Depression (40 patients)

5 scanning sessions
45 min each



Medical Research Council Developmental Clinical Study "Neurofeedback in Depression" (Isabelle Habes, Moses Sokunbi)

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



Coordination



Methodology

Trials



Transfer-Technology

www.braintrainproject.eu

Key challenges I: Psychiatric surgery & DBS

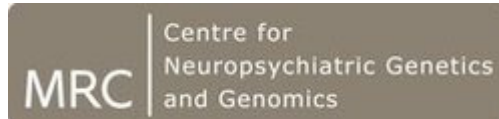
- Define rational targets - needs improved understanding of underlying circuits (or compensatory mechanisms)
- Formal treatment trials - problem of control
- Ethical/ societal issues - what are the limitations (consent, offenders, prevention, "behavioural disorders"?)

Key challenges II: Clinical effects of fMRI-NF

- RCTs needed (but need to be adapted)
- Identify appropriate patient groups and protocols/ treatment combinations
- Identify target area or pattern
- Devise suitable control condition(s)
- Assess economic impact, transfer, sustainability

Transfer technologies





Depression:

**Isabelle Habes, Kali Barawi
Moses Sokunbi, Maxence Range**

PD:

**Leena Subramanian
Huw Morris (neurologist)
Monica Busse (physiotherapist)**

Motivation/ alcohol:

Niklas Ihssen

MR physics:

John Evans

Capsulotomy:

**Brian Simpson (neurosurgery)
Gwen Phillips (neuropsychology)
Peter Jenkins (psychiatry)**



**Take part in NCMH
brain imaging research**