Robotized Transcranial Magnetic Stimulation (TMS)

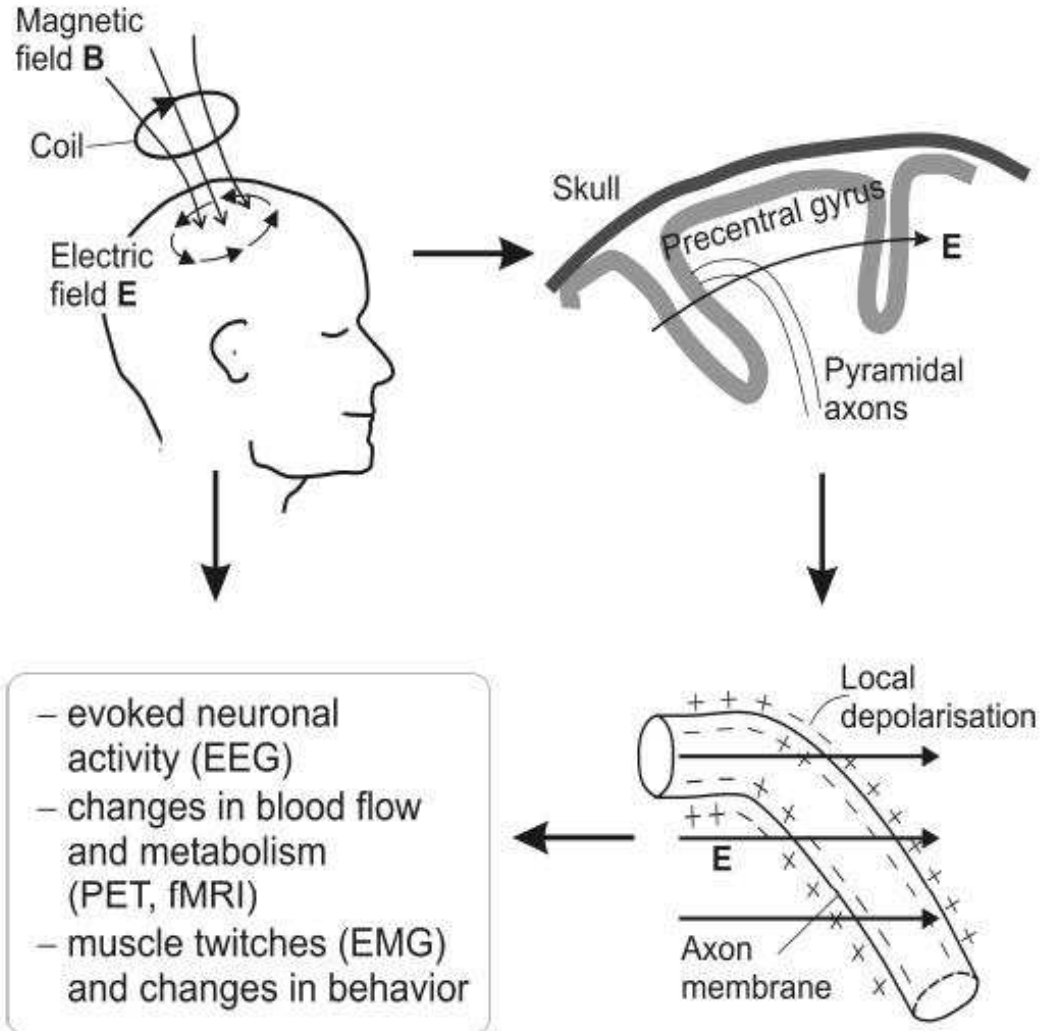
4th European Summer University in Surgical Robotics, Montpellier

Lars Richter

Institute for Robotics and Cognitive Systems,
University of Lübeck
&
Graduate School for Computing in Medicine and Life Sciences,
University of Lübeck

September, 2009

Transcranial Magnetic Stimulation (TMS)



Jarmo Ruohonen. *Transcranial Magnetic Stimulation: Modelling and New Techniques*, 1998

Changing currents in the coil

1. ⇒ Changing magnetic field
2. ⇒ Magnetic field passes through the skull
   ⇒ Induces an electric field in the brain
3. ⇒ Local depolarisation of axons
4. ⇒ The neuron becomes activated
5. ⇒ Response

Motivation

- Why does TMS sometimes work and sometimes fail
  - For depression?
  - For chronic pain?
  - For chronic tinnitus?
  - ⋮
- An automated system unifies involentary experimental conditions
  - Positioning
  - Motion
  - Treatment time
- Is this the answer?

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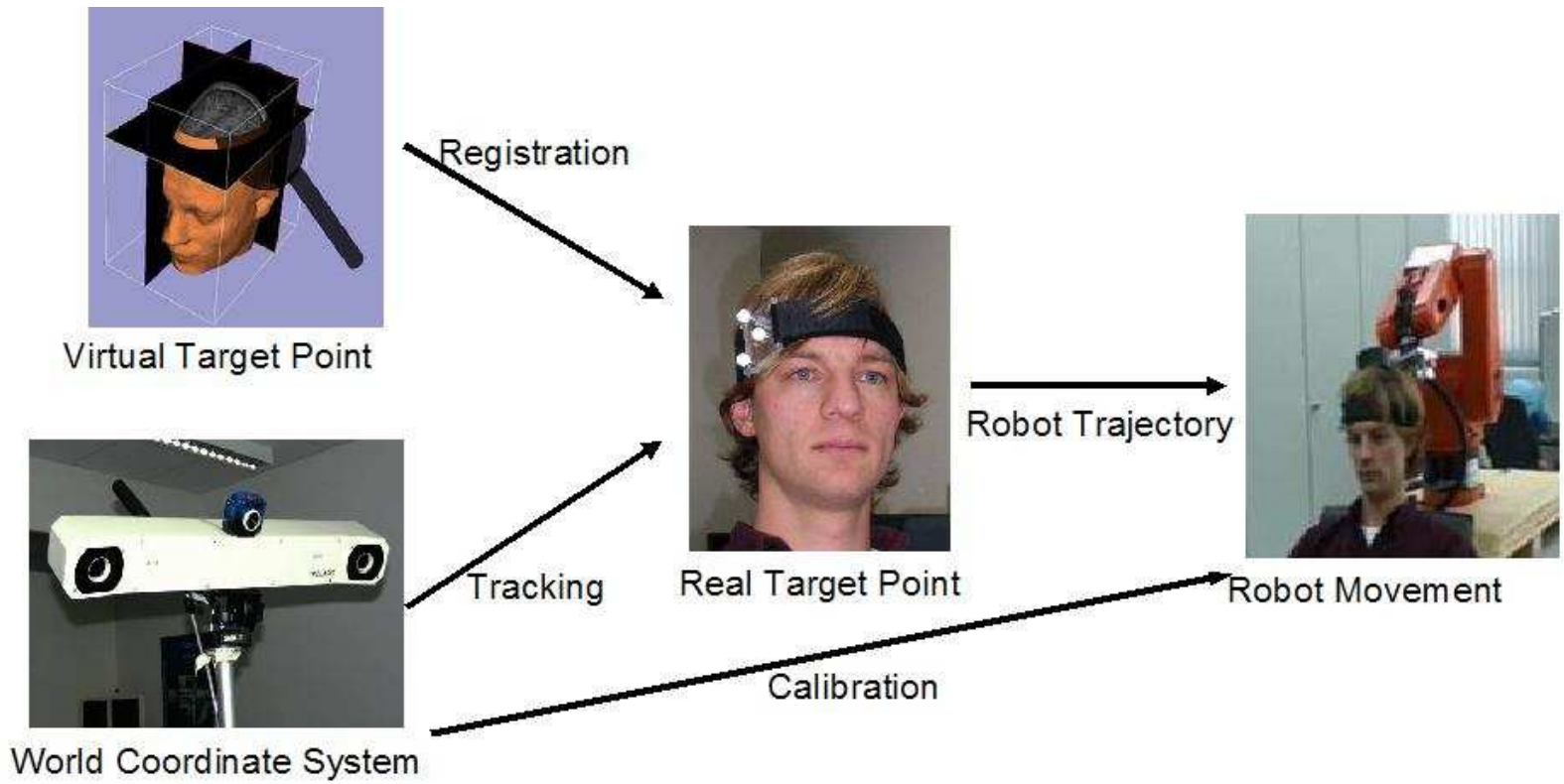
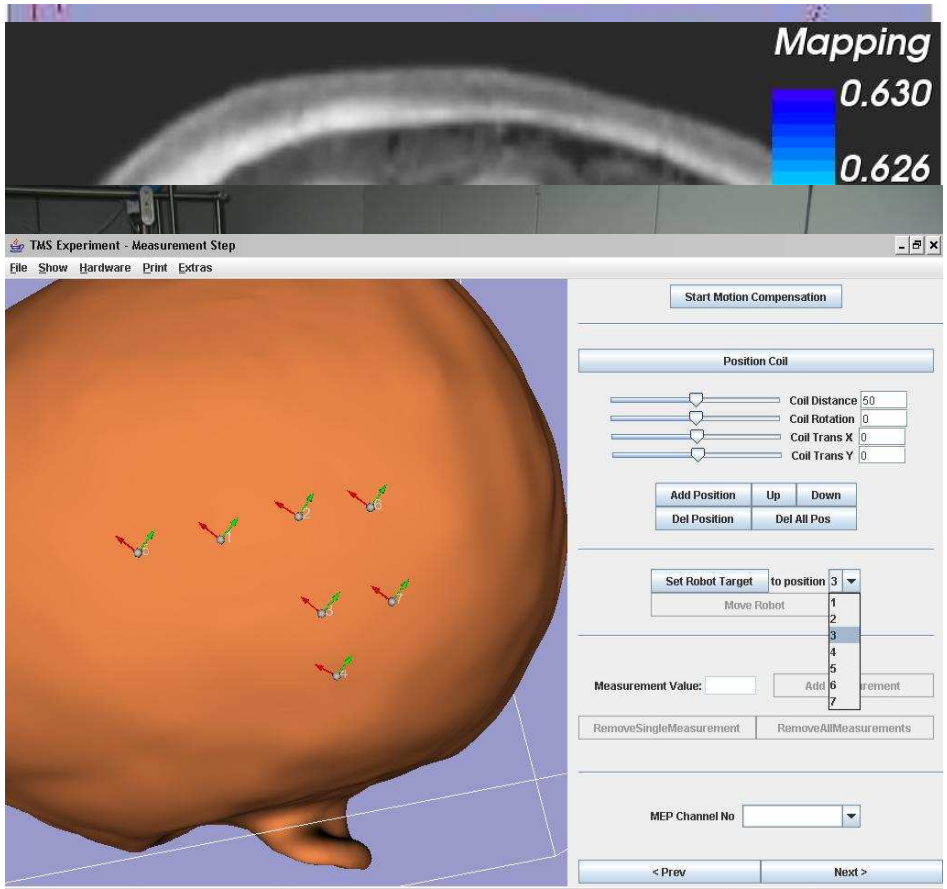
How the robot system works

- Calibration: Robot to Trackingsystem
- Registration: Virtual Target Point $\Rightarrow$ Real Target Point
- Tracking: Real target point is tracked
- Robot trajectory: Robot is moved to real target point



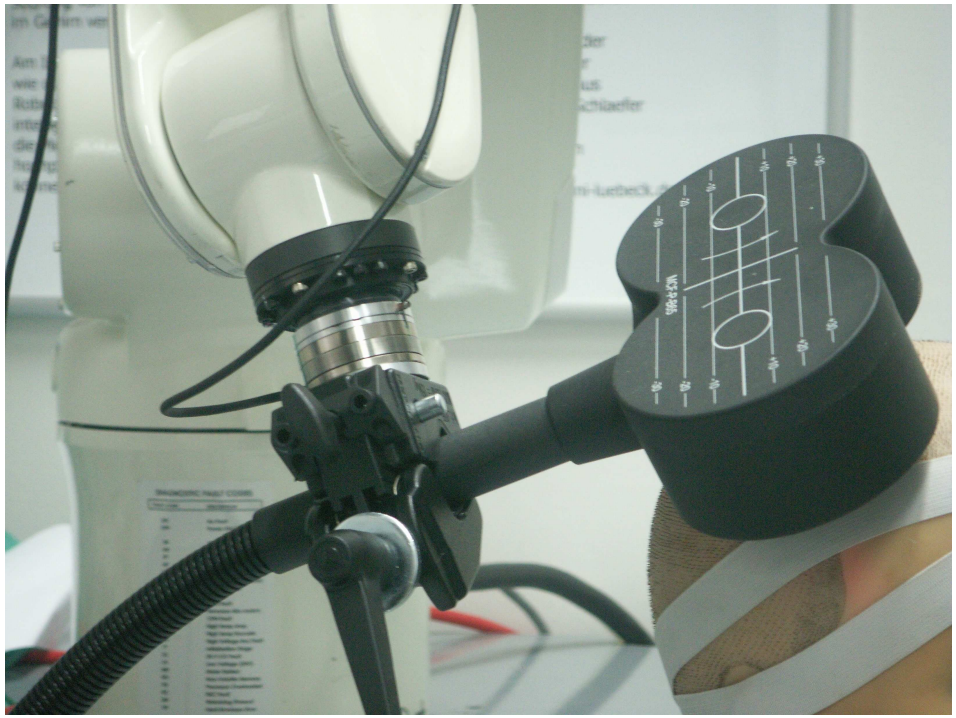
Features

- High Precision TMS
  - Precise analysis and documentation
  - Brain mapping
  - Using fMRI / PET targeting
- Motion Compensation
  - Avoid head fixation
  - Keep high precision during treatment
- Repeatable Stimulation
  - Intra-session: Finding a „hot-spot“
  - Inter-session: Treatment over days



Next Steps

- Clinical studies
  - Chronic Tinnitus
  - Alcoholism
  - Influence of coil-orientations
- Force-Torque-Sensor
  - For safety
  - For precision
  - For usability



Thank you!

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