

CYPRUS UNIVERSITY OF TECHNOLOGY
FACULTY OF HEALTH SCIENCES
DEPARTMENT OF REHABILITATION SCIENCES

Transcranial Magnetic Stimulation (TMS) in post-Stroke Aphasia Rehabilitation

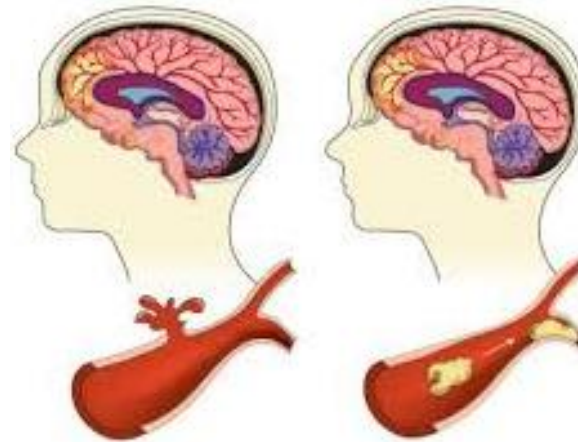
Anastasios M. Georgiou, PhD c.

Aphasia



- acquired language disorder

□ injury to the brain – most typically **stroke** in the left hemisphere



haemorrhage

ischemia

Basic concepts related TMS

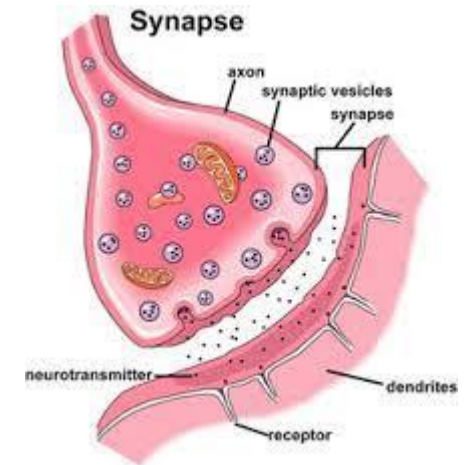
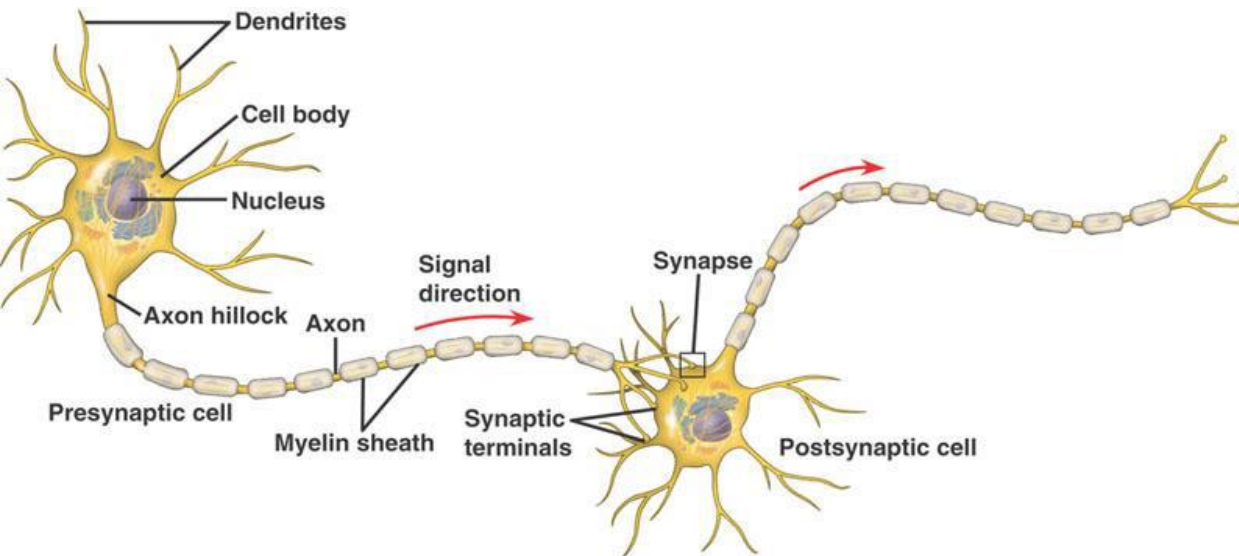
Synapse

Neuroplasticity

TMS

A blue bracket on the right side of the page groups the words 'Synapse' and 'Neuroplasticity' together. A line extends from the center of the bracket's opening towards the word 'TMS'.

Synapse

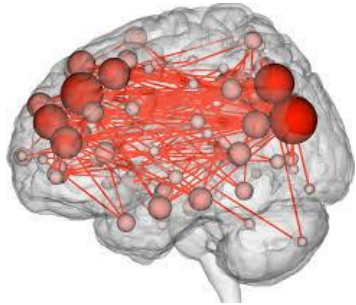


Neuroplasticity / Brain plasticity

- changes in brain **structure** and **functional organisation**
 - Experience
 - Learn
 - Adapt to changes in the environment (e.g. injury)

Transcranial Magnetic Stimulation (TMS)

- ✓ non-invasive
- ✓ safe



- ✓ Investigation of brain areas that are responsible for specific functions

- ✓ Stimulation of areas of interest for treatment

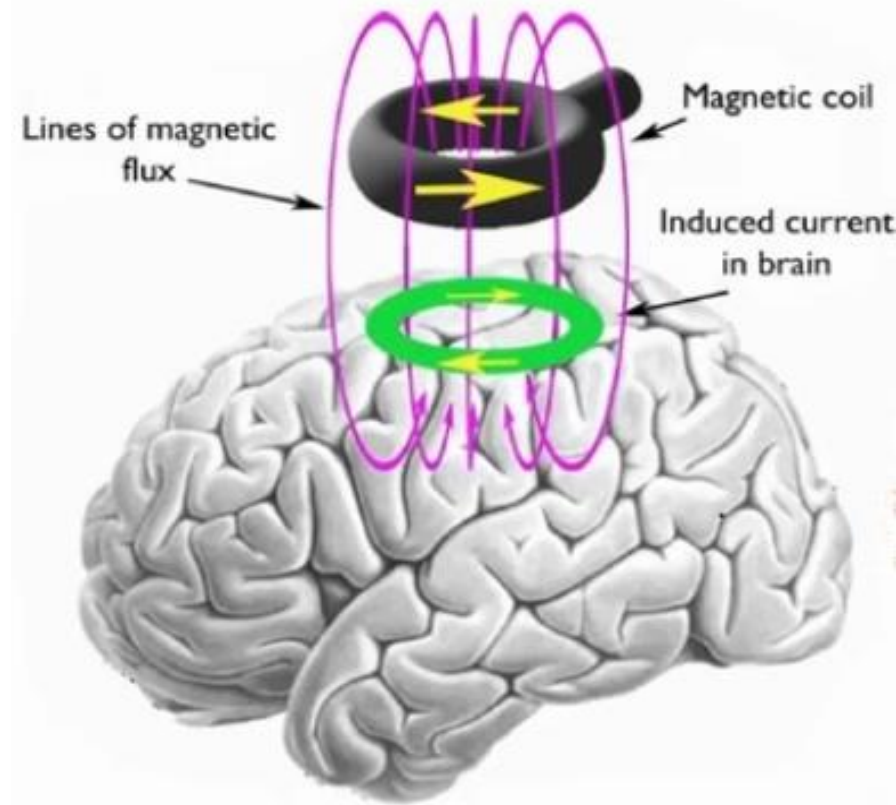


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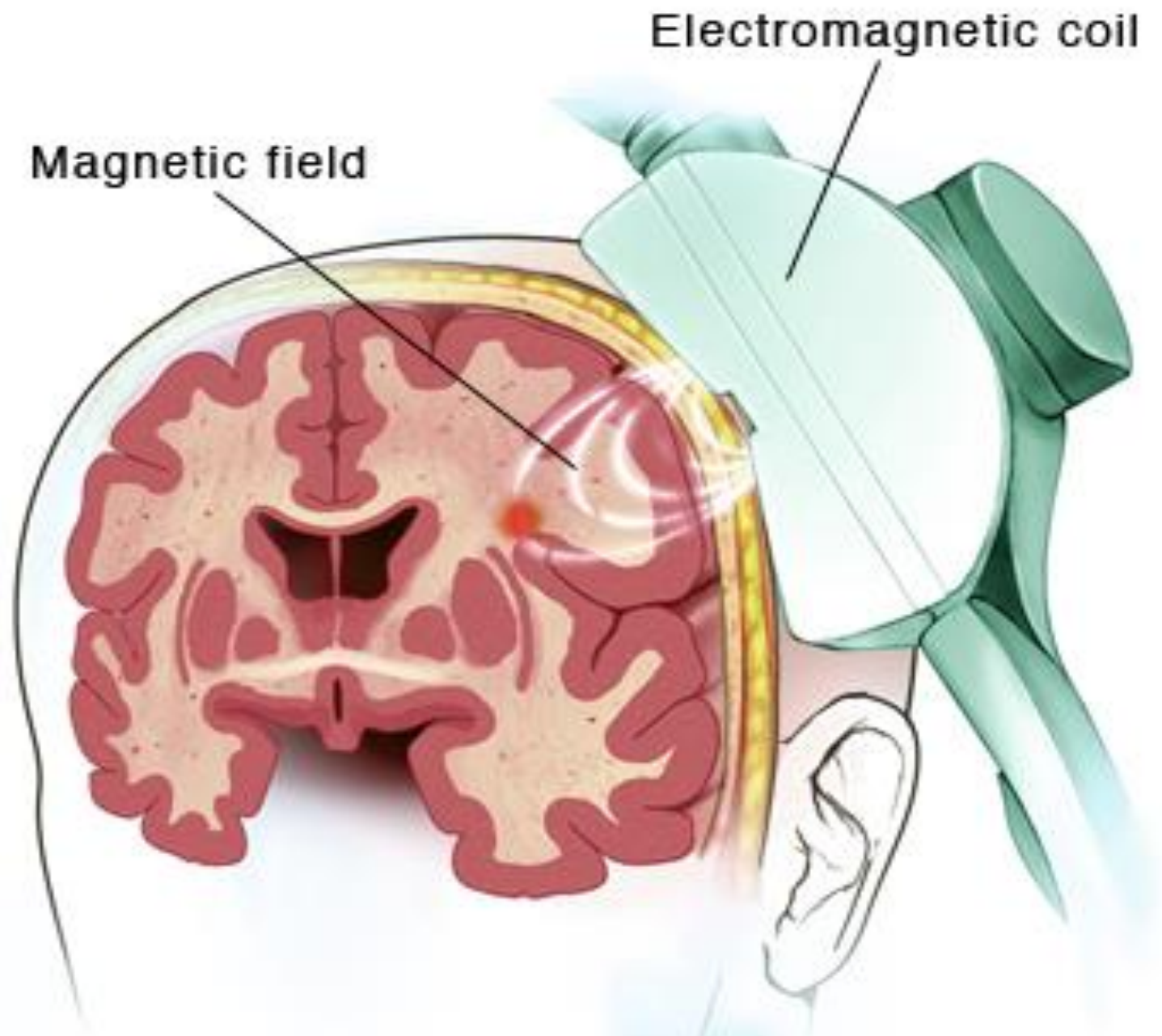


Basic Principles

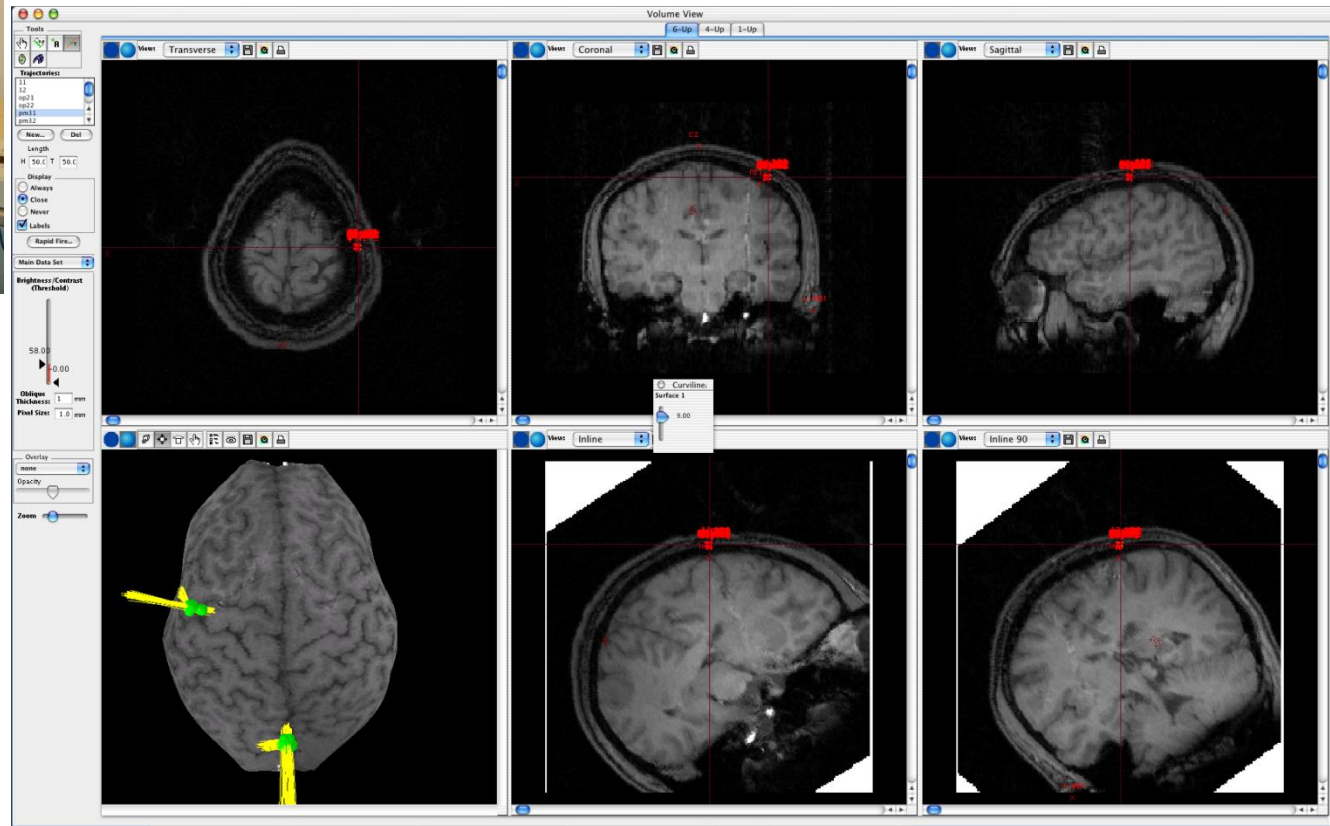
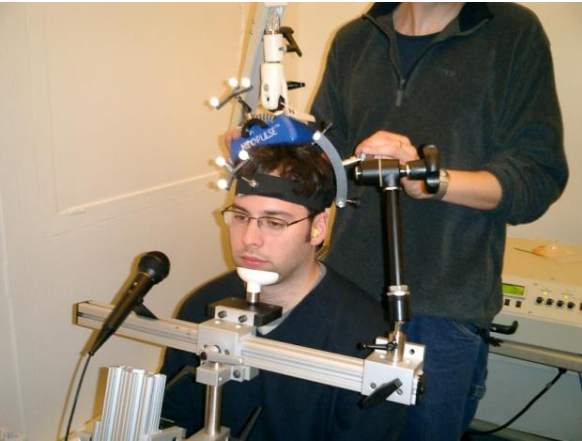
electromagnetic induction (1831)



- time-varying current (value/direction) → magnetic field → electric field and hence a secondary current within nearby conductors
 - there is always electric current flowing through neurons
 - TMS stimulates neurons that act as conductors !
- The more current in the coil, the stronger the magnetic field

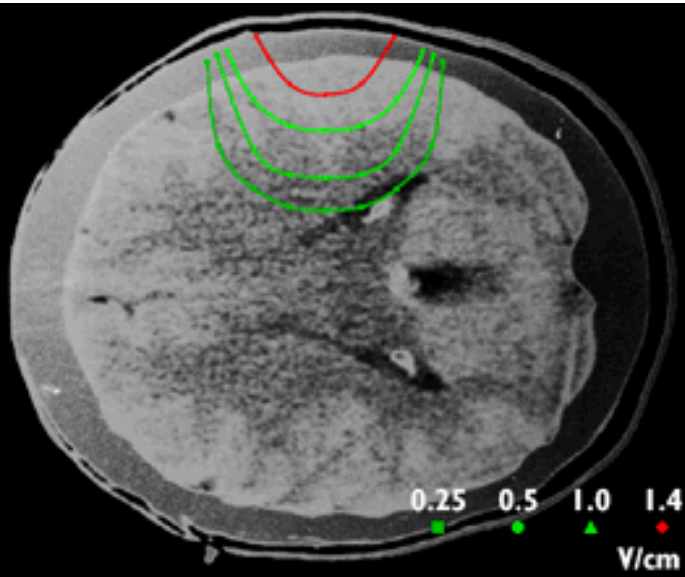


Neuronavigated TMS

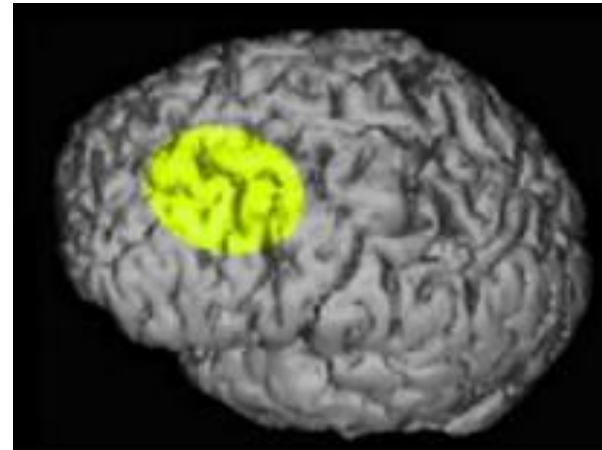


- ✓ consistent, precise and individual targeting
- ✓ precise coil orientation
- ✓ monitoring of brain stimulation
- ✓ reliable stimulation at targets defined in previous sessions

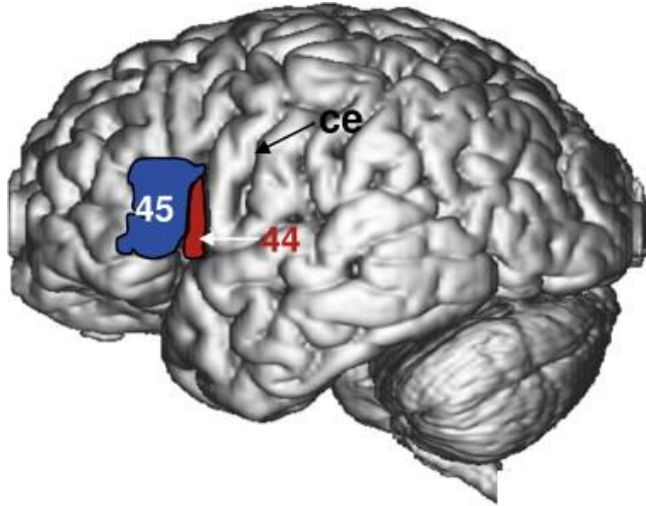
How deep can we go ? How focal is the stimulation?



Induction of magnetic fields up to
2-3 cm below the skull
(i.e. superficial cortical targets)



Protocol: Inhibitory rTMS

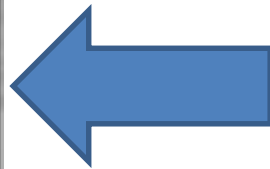
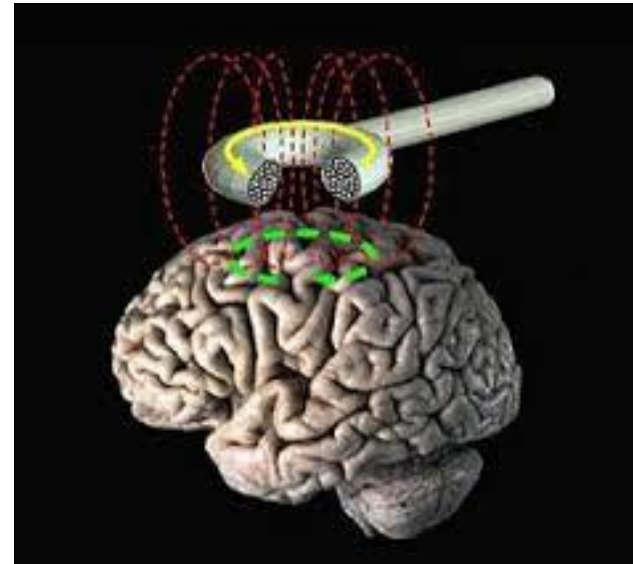
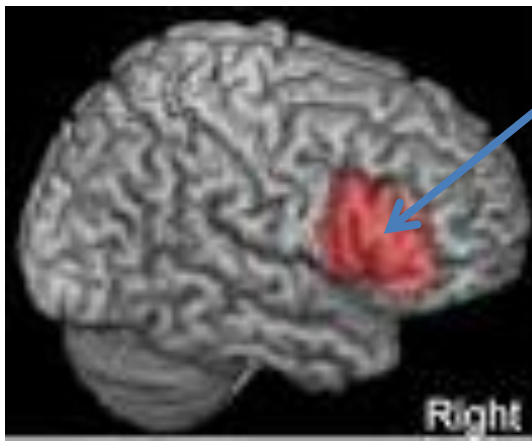
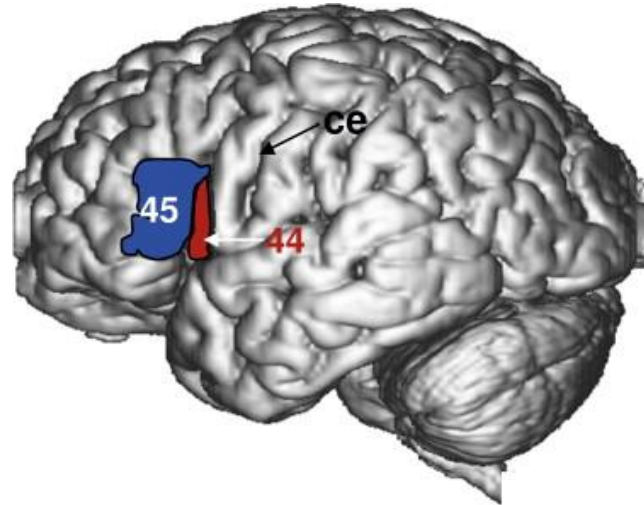


Broca's area (BA44 & BA45) of the left hemisphere is a core area of the speech production system for almost 97% of people

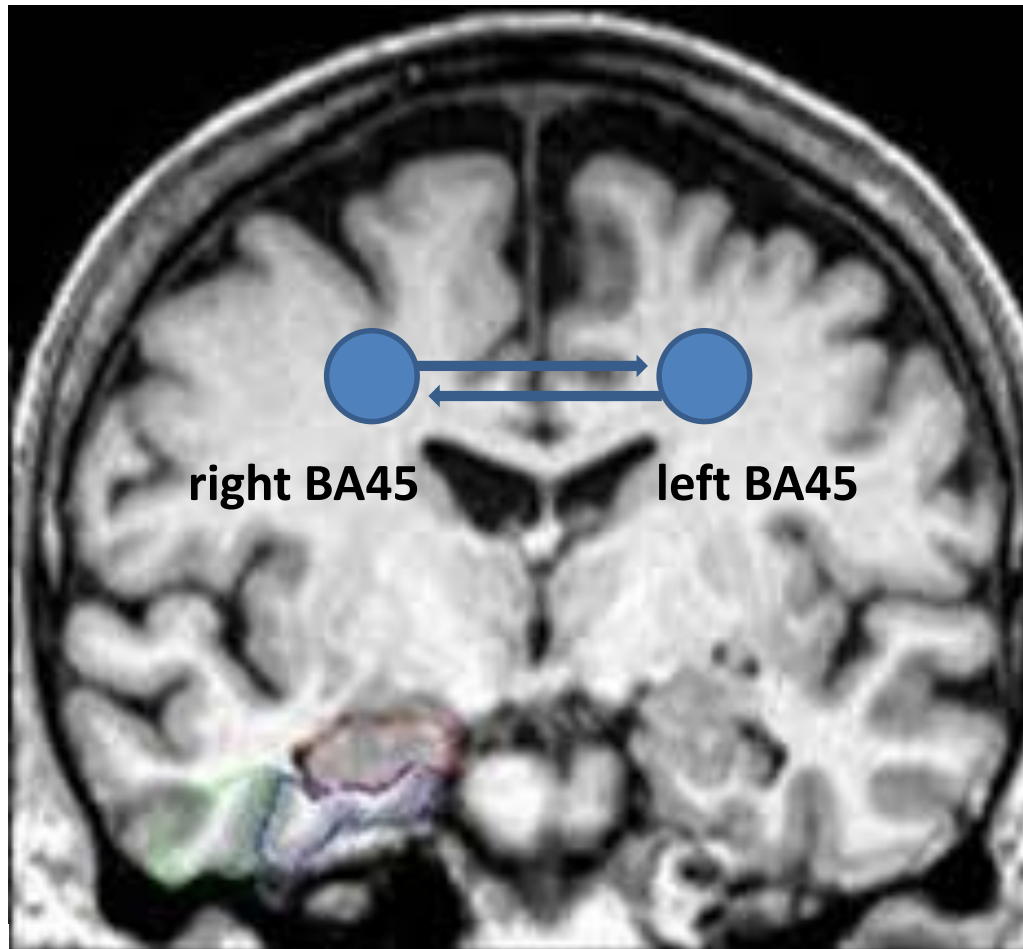
✓ anterior lesions affecting Broca's area cause the so called "non-fluent" aphasia (→ reduced speech output)

✓ posterior lesions affecting this area here, called Wernicke's area cause fluent aphasia (→ incoherent speech)

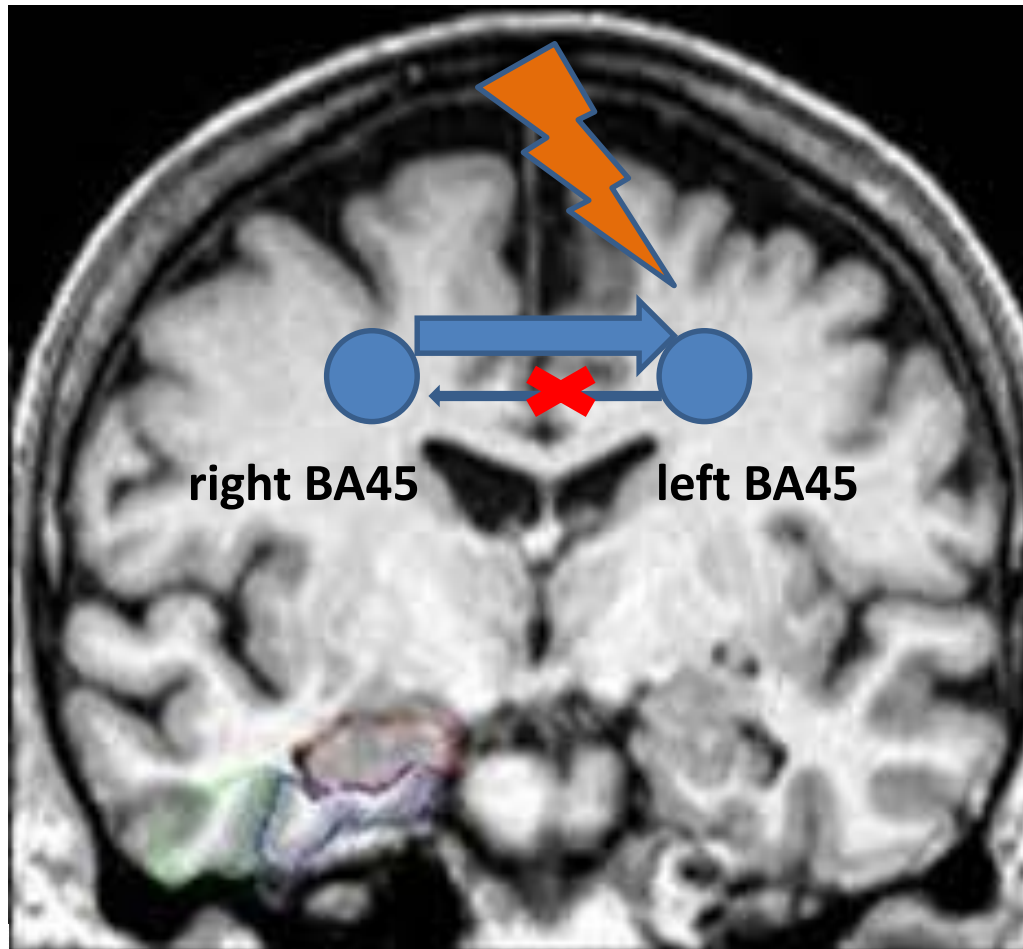
Protocol: Inhibitory rTMS



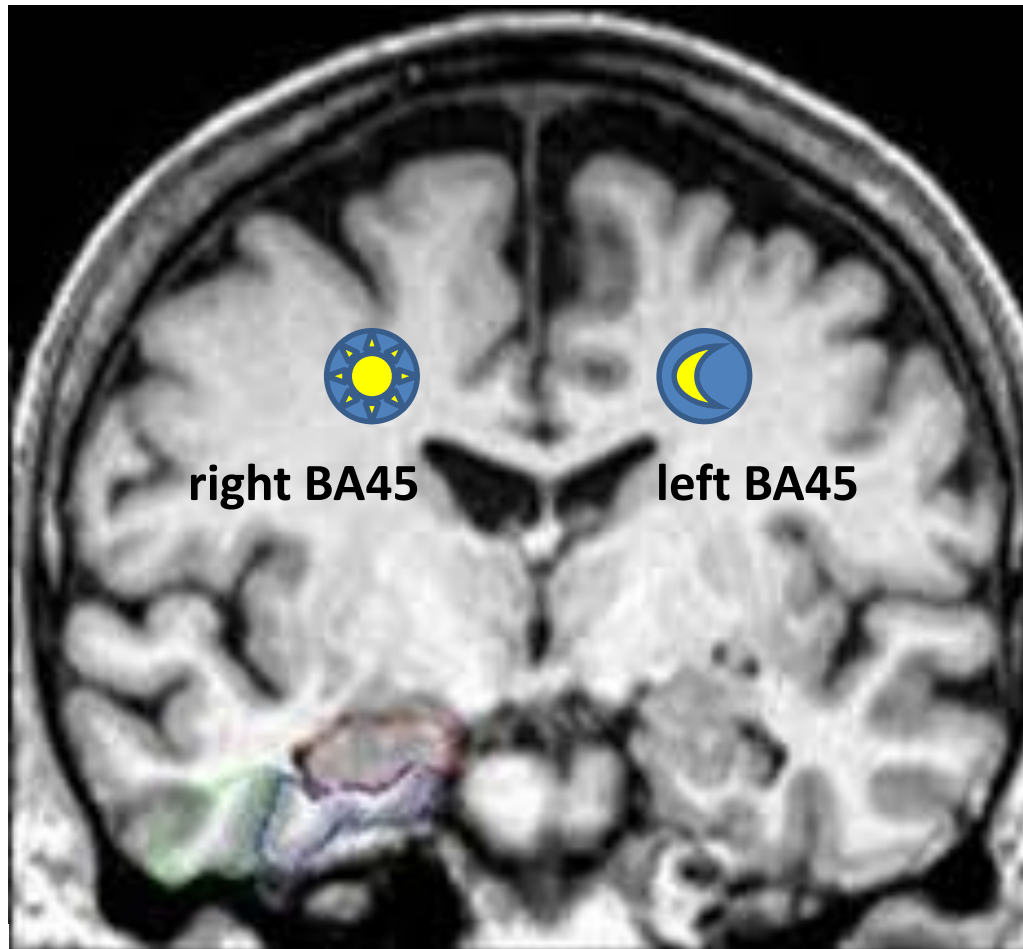
Rational for using Inhibitory rTMS



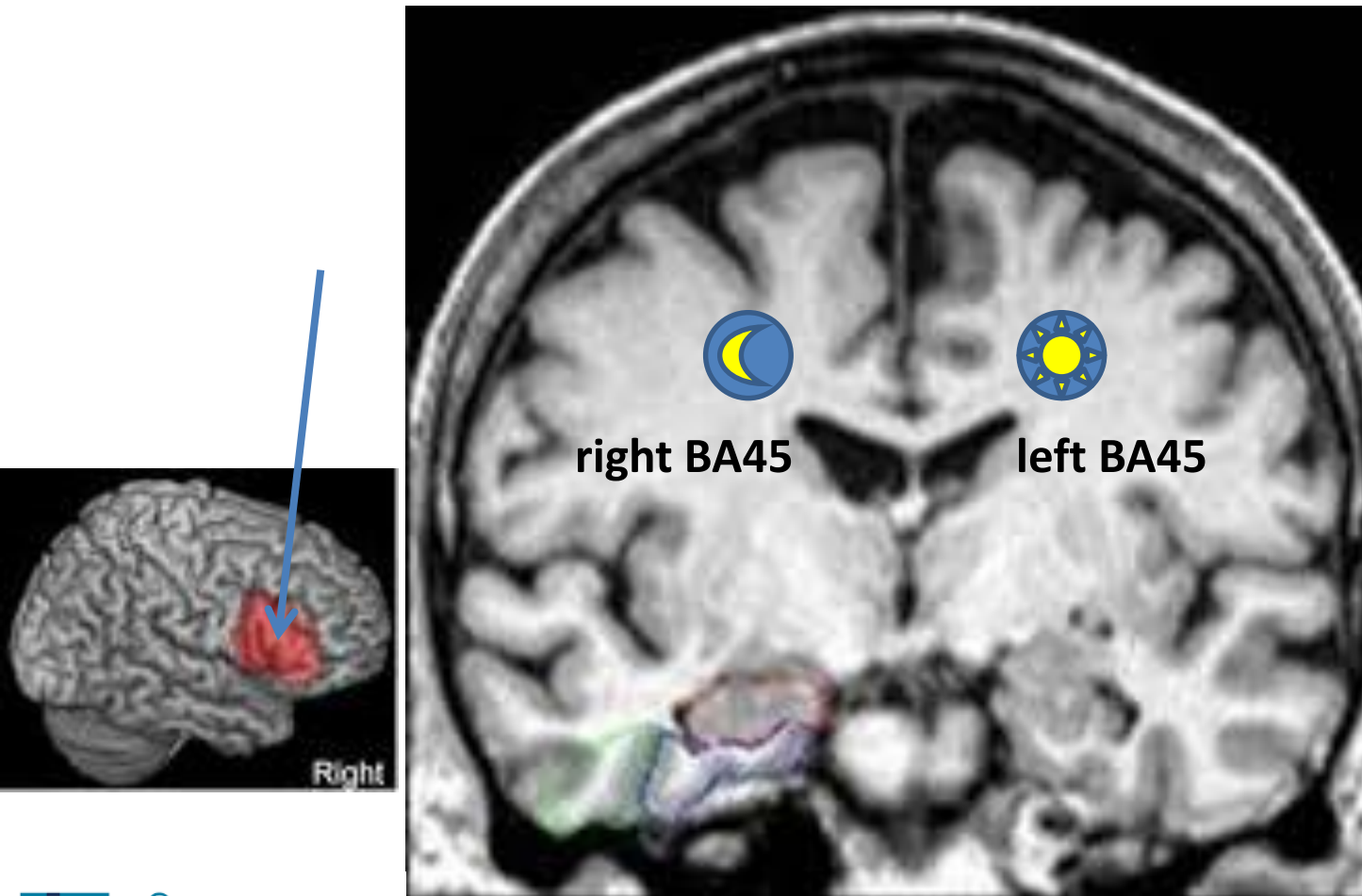
Rational for using Inhibitory rTMS



Rational for using Inhibitory rTMS



Rational for using Inhibitory rTMS





Take home message



THE LANGUAGE OF SCIENCE

