“Künstliche Intelligenz oder “reale Intelligenz”

Das Netzwerk “Gehirn”

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Figure 2.3
Golgi-stained neurons. (Source: Hubel, 1988, p. 126.)
Figure 2.7
A tour of the neuron.
Figure 7.26
Brodman’s cytoarchitectural map of the human cerebral cortex.
Low vision after brain damage

black-and-white view of the visual world
Measuring the visual field with computer-based perimetry

Visual field chart shows detection performance in a hemianopic patient. White: seeing area; black: blind area. But: the border is usually fuzzy and variable! This is one region of particular interest for vision restoration.
Residual vision after brain damage: Not „black or white“ but „shades of grey“

Areas of „residual vision“ (=relative defects) are shown in grey: they are revealed by repeated visual field testing of by near-threshold testing.

The size of areas of areas of residual vision (grey) are different in different patients. They range from Type I very small („sharp borders“) with a large region of absolute blindness to large (Type III).
Residual vision: not black-or-white, but shades of grey

The extent of vision loss (detection ability) is a direct function of neuron loss: the greater the cell loss, the greater is the field defect in different regions of the visual field. Areas of residual vision (ARVs) can be found in all kinds of visual field defects such as after stroke (hemianopia) or retinal damage (glaucoma).
Question: how to maintain stimulation effects?
Answer: Synaptic plasticity after partial brain injury: Long-term potentiation

When a neuronal network is repeatedly stimulated, it will strengthen its synaptic transmission (=long term potentiation = learning). This principle holds true also for partially damaged networks.
Treatment:

Non-invasive repetitive transorbital ACS (rtACS)

(10 days, approx. 20-40 min daily, treatment of intact and damage eye)

Stimulation parameters:
→ Determine current thresholds for phosphene perception
→ Stimulate above phosphene threshold (max. current intensity = 1000µA)
→ Frequencies random between individual α-range (min) in background EEG and flicker fusion (max)
Results:
Visual fields after optic nerve lesion

baseline

HRP

Standard Perimetry

Patient CG: Traumatic optic nerve lesion
After 10 days of rtACS therapy

Visual field after optic nerve lesion

Patient CG: Traumatic optic nerve lesion
Stimulation with non-invasive brain stimulation improves vision

Study I: randomized, double-blind, placebo-controlled clinical trial - EEG analysis

**ELECTRICALLY INDUCED BRAIN SYNCHRONIZATION. EEG STUDY**

Before rtACS

After 10 days

EEG alpha power spectra

min  max

rtACS group
Connectivity charts show which brain regions talk to each other.
High-Gamma Band (60-90Hz): Finger-tapping motor task

Before tDCS

After tDCS

(A)  

(B) (+)