



Applying tDCS

the unique tool for cognitive modulation and clinical application

Patrik Šimko



central european institute of technology
BRNO | CZECH REPUBLIC



MASARYKOVA UNIVERZITA

Content

- Questions related to tDCS application.
 - Why?, What?, Who?, Where and How?
- Modulating functions in the normal brain
- Experimental clinical application
 - PD, AD
- Summary



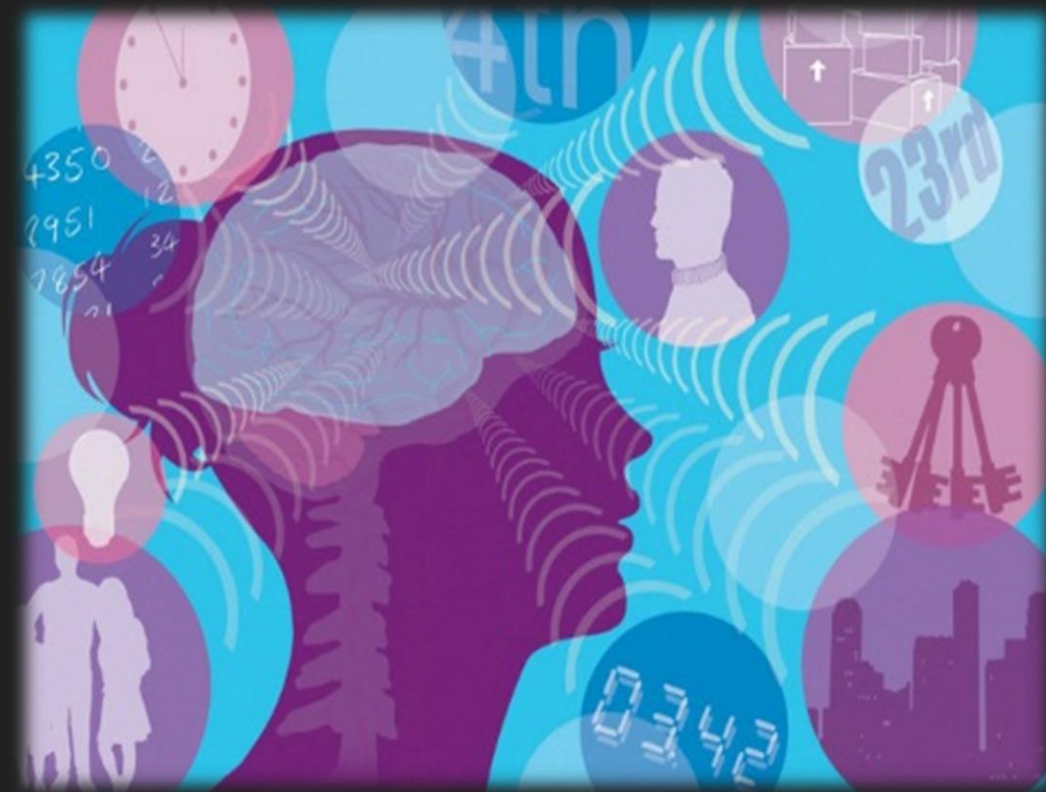
Questions related to tDCS application

- **Why** tDCS? – rationale for clinical and experimental application
 - Advantages in implementation
 - Relevant mechanism of action
- **What** for? – normal brain, pathology
 - Psychiatric and neurological disorders;
- **Who** stimulates/gets stimulated?
- **Where/how** to stimulate - stimulation parameters in concrete clinical treatment



Modulating functions in the normal brain

- **Enhancement versus suppression**
- Modulation of:
 - sensory functions
 - motor functions
 - cognitive functions
 - affectivity



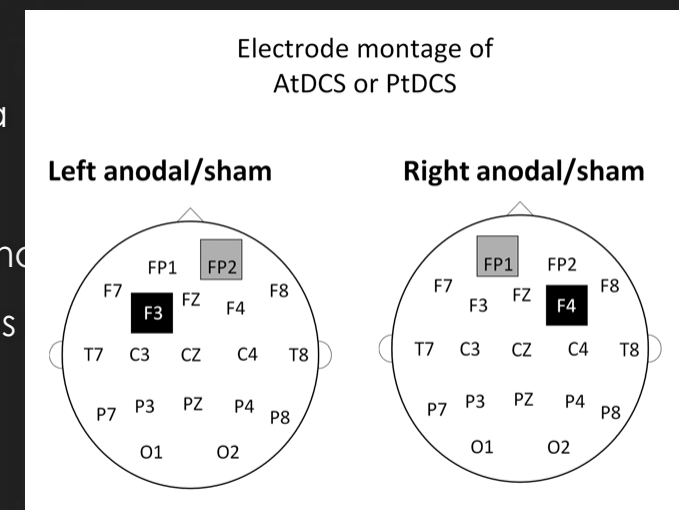
Clinical application of tDCS

- Studies in normal subjects with tDCS inform about potential clinical interventions = **tDCS in TRANSLATIONAL COGNITIVE NEUROSCIENCE**
- **Augmentation**
- **Replacement**
- Most frequent areas of experimental clinical tDCS application:
 - Post stroke rehabilitation – paralysis, aphasia, neglect
 - Pain
 - Depression
 - Neurodegenerative disorders



tDCS In Parkinson's Disease

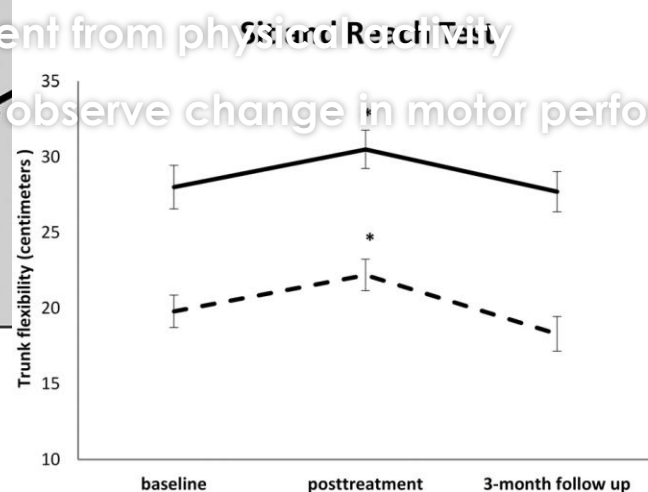
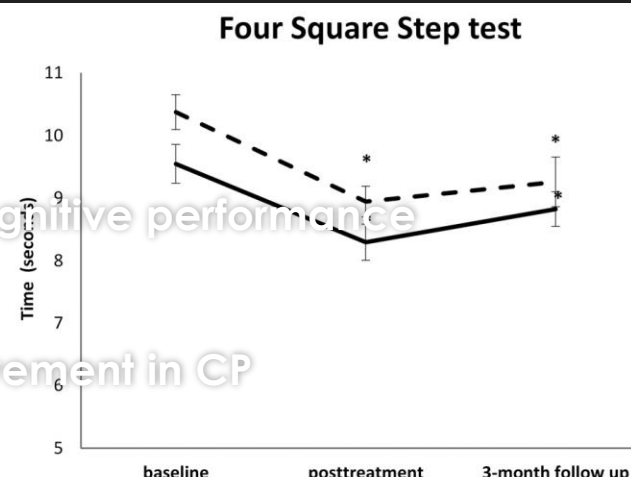
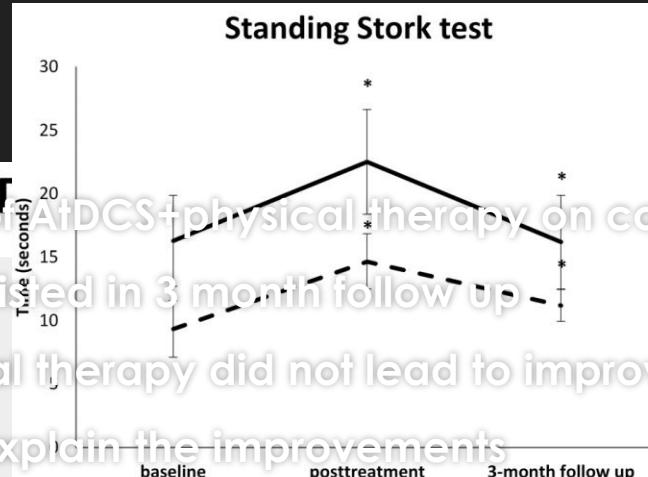
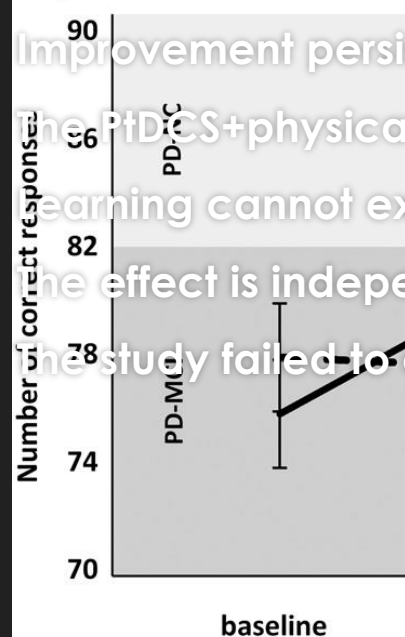
- “Mild Cognitive Impairment in Parkinson's Disease Is Improved by Transcranial Direct Current Stimulation Combined With Physical Therapy” (Manenty et al., 2016)
- **Aim:** effect of anodal tDCS applied over DLPFC combined with physical therapy in PD (treatment and placebo group 10:10)
- **Participants:** 20 PD fulfilled UK PD Brain Bank for diagnosis of **idiopathic PD**.
- **Methods:**
 - anodal tDCS – DLPFC, cathode – contralateral supraorbital area (2mA for 25 min.); Sham 10 sec. after stimulation start
 - physical therapy – individualised, in account the core areas of motor
 - clinical/neuropsychological/motor task performance in 3 months



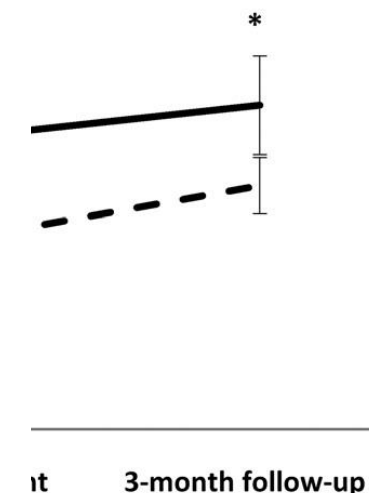
tDCS In Parkinson's Disease

Results design:

- Significant effect of tDCS+physical therapy on cognitive performance
- Improvement persisted in 3 month follow up
- The tDCS+physical therapy did not lead to improvement in CP
- Learning cannot explain the improvements
- The effect is independent from physical activity
- The study failed to observe change in motor performance

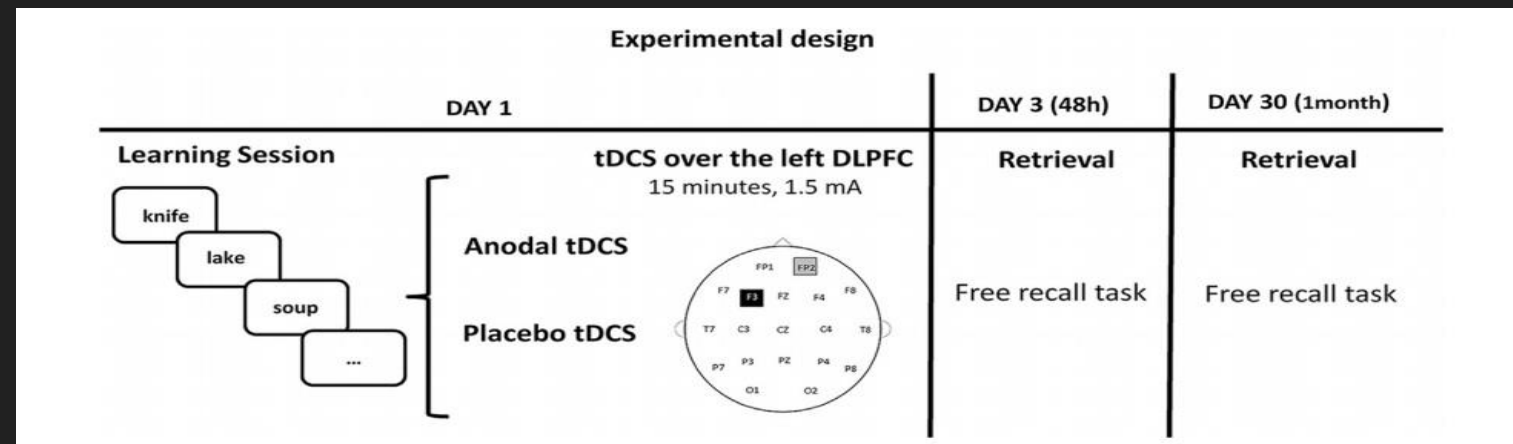


Cortical Score



tDCS in Alzheimer's disease

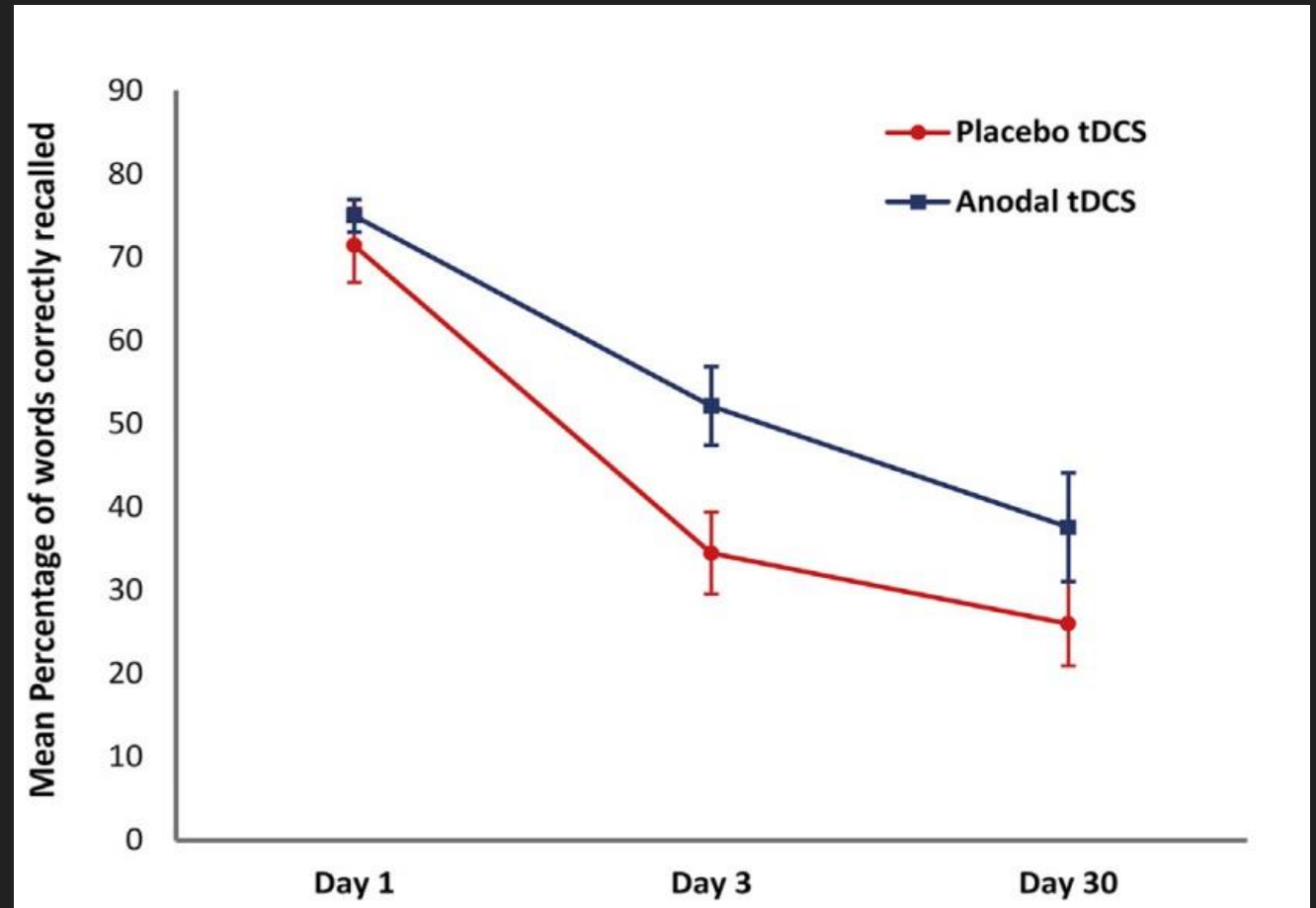
- **Methods:** "Adults get episodic memory boosting from noninvasive stimulation of prefrontal cortex during learning" (Sandrini et al., 2016)
 - anodal tDCS – DLPFC, cathode – contralateral supraorbital area <1-2mA> for 15-20 min.); Sham 10 min. after stimulation start
- **Aim:** test the effect of tDCS over ILPFC on recall of verbal episodic memories in elderly individuals
- **Procedures:**
- **Participants:** 28 older individuals, mean age = 68.9y
 - list of object words to memorize (20), 10/5 learning trials or 17/20 words
 - Memory strategies questionnaire
- **Experimental design:**



tDCS in Alzheimer's disease

○ Results:

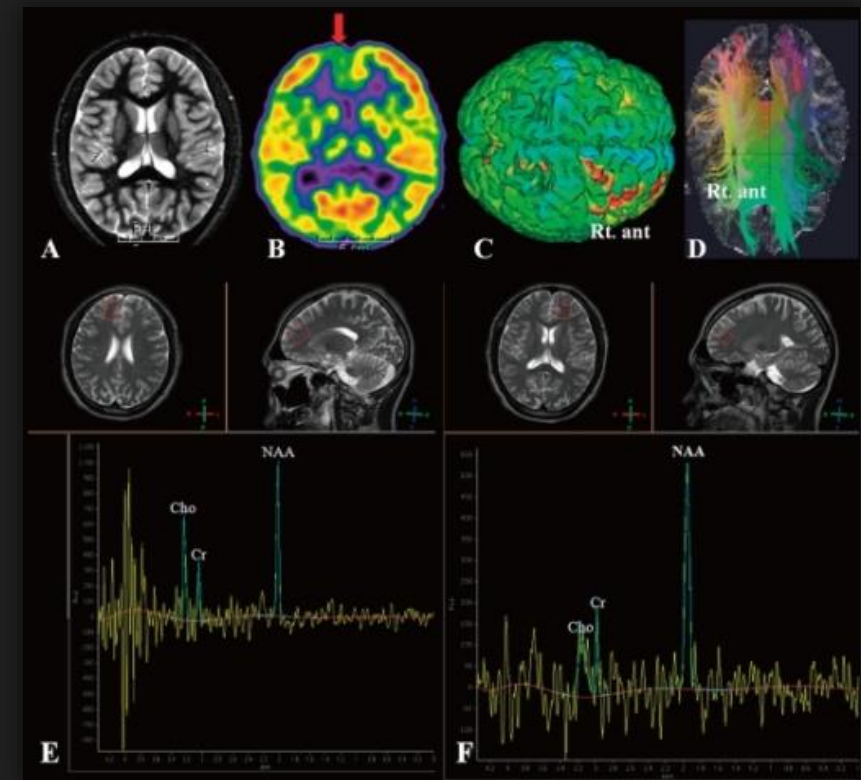
- AtDCS over IPFC during learning reduced forgetting up to 48 h compared to placebo
- No significant effect after 1 month
- tDCS enhanced the delayed free recall



Summary and future directions



- The behavioral changes observed in cognitive abilities induced by tDCS are encouraging
= **basis for future research**
- Need more data, larger samples, optimal parameters
- Multimodal approach = combine with **neuroimaging!!!**



Thank you 😊

