

Neurofeedback & Impulsiveness

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Acknowledgements / In cooperation with:

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Impulsiveness and neurofeedback research

Multidimensional aspects of impulsiveness

Impulsiveness expresses itself at the

Motor level: difficulty inhibiting prepotent responses; difficulty suppressing unwanted behavior, resisting temptation; difficulty waiting

Cognitive level: insensitivity to delayed consequences; lack of planning, lack of forethought

Emotional level: uncontrolled irritable temperament

Social level: social disinhibition

Impulsiveness is the opposite of self-control

Impulsiveness as a core symptom in psychopathology

(e.g. ADHD, Borderline, Addiction, Sociopathy & Personality Disorders)

Method: Selection & Measures

Participants: N= 102 healthy students

Selection:

- Barratt Impulsiveness Scale (BIS-11)
- BIS-BAS (BAS-funseeking, BAS-drive, BAS-reward)
- Cloninger Sensation Seeking Check list

After selection: N= 30 (Random assignment to 3 conditions) (n=10):

I. Control group

II. 'sham' neurofeedback

- 8 training sessions (30 min); random rewards C4 for 4-20Hz; 30-38Hz; e.g.

III. Experimental group

- 8 training sessions (30 min); reward C4: 12-15Hz (smr-protocol)

Pretest – Posttest Measures

- I. Continuous Performance Task (a-x - CPT) - *behavioral inhibition*
- II. Stroop - *interference inhibition*
- III. Antisaccade task - *oculomotoric inhibition*
- IV. Visual 2 stimuli Go-Nogo Task - *behavioral inhibition*
- V. EEG (2 min eyes closed/ eyes open) / ERP-measures

Electroencephalogram (EEG) was recorded by 21-channel EEG system (Mitsar). 19 silver-chloride electrodes were placed on the scalp according the standard 10-20 system. The input signals referred to the tip of the nose were amplified (bandpass 0.5-30 Hz) and sampled at the rate of 250 Hz. EEG power values were calculated for a reference free, weighted average montage according to Lemos

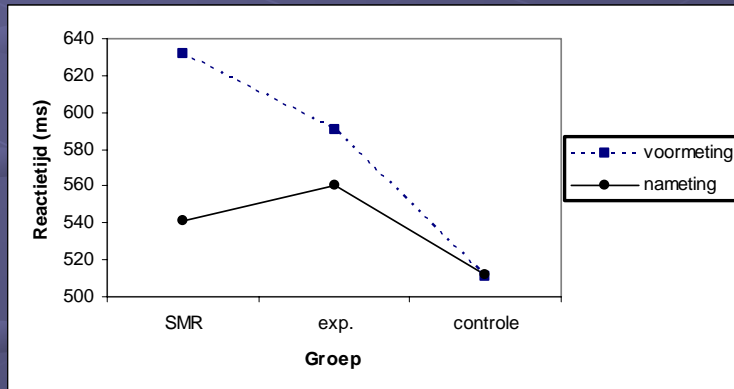
Results

Non significant results:

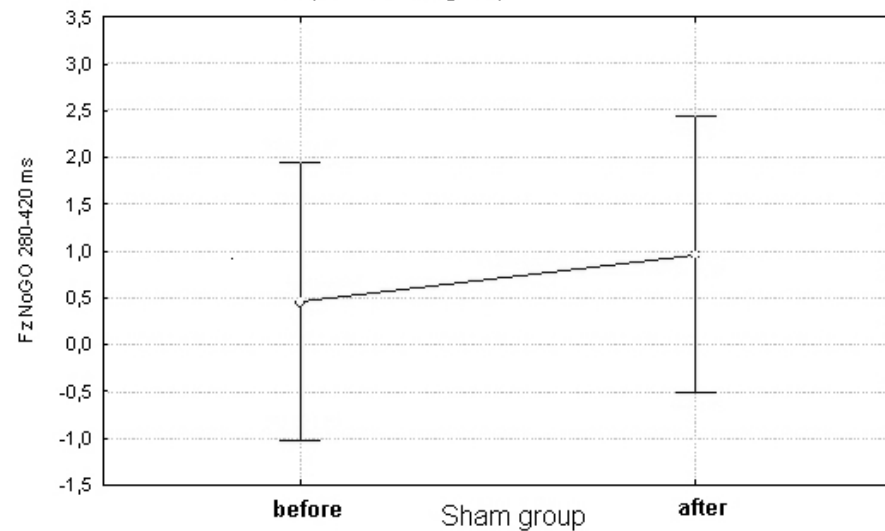
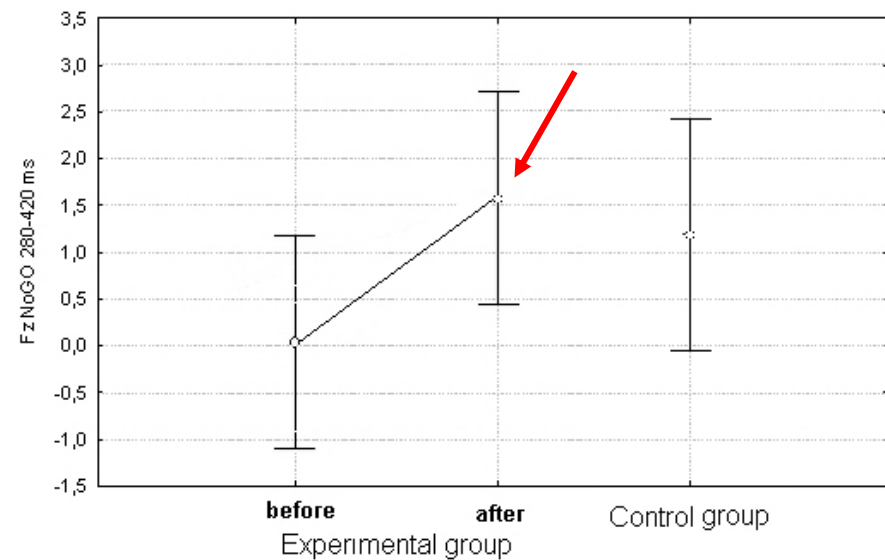
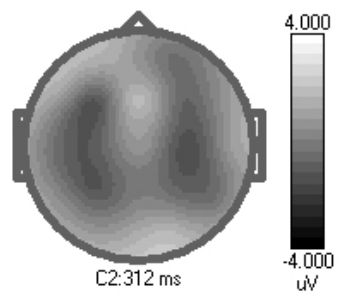
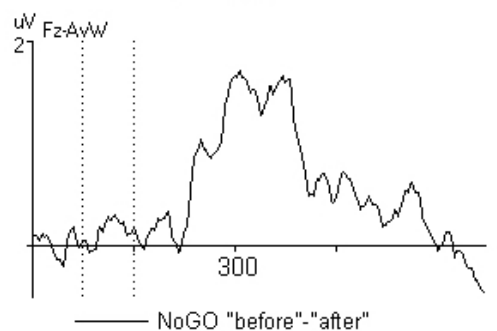
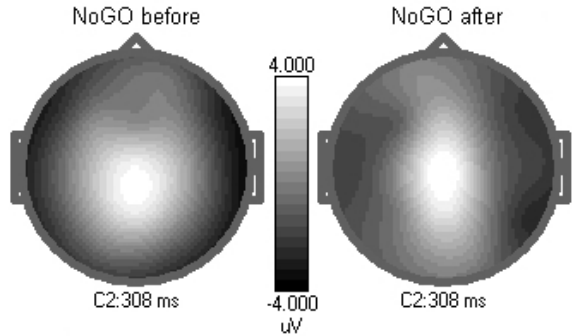
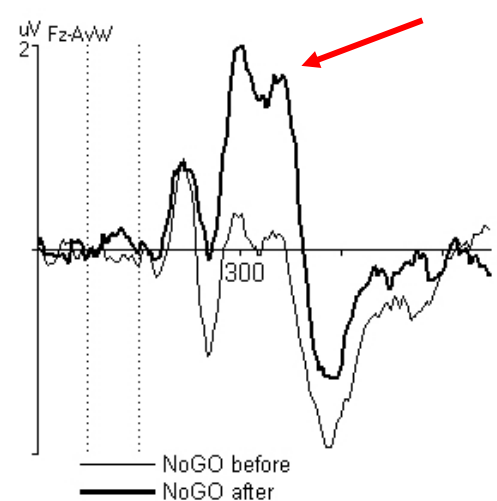
- Continuous Performance Task - *behavioral inhibition*
- Antisaccade task - *oculomotoric inhibition*
- **QEEG**: spectral analyses eyes closed / eyes open condition

significant results:

- **Stroop** - *interference inhibition* (**Group x time: $F(2, 26)= 8.61, p<0.01$**)



- **ERP's Visual 2-stimuli GO-Nogo Task** - *behavioral inhibition*
variable: P300 for NoGo conditions (index of Impulsivity)



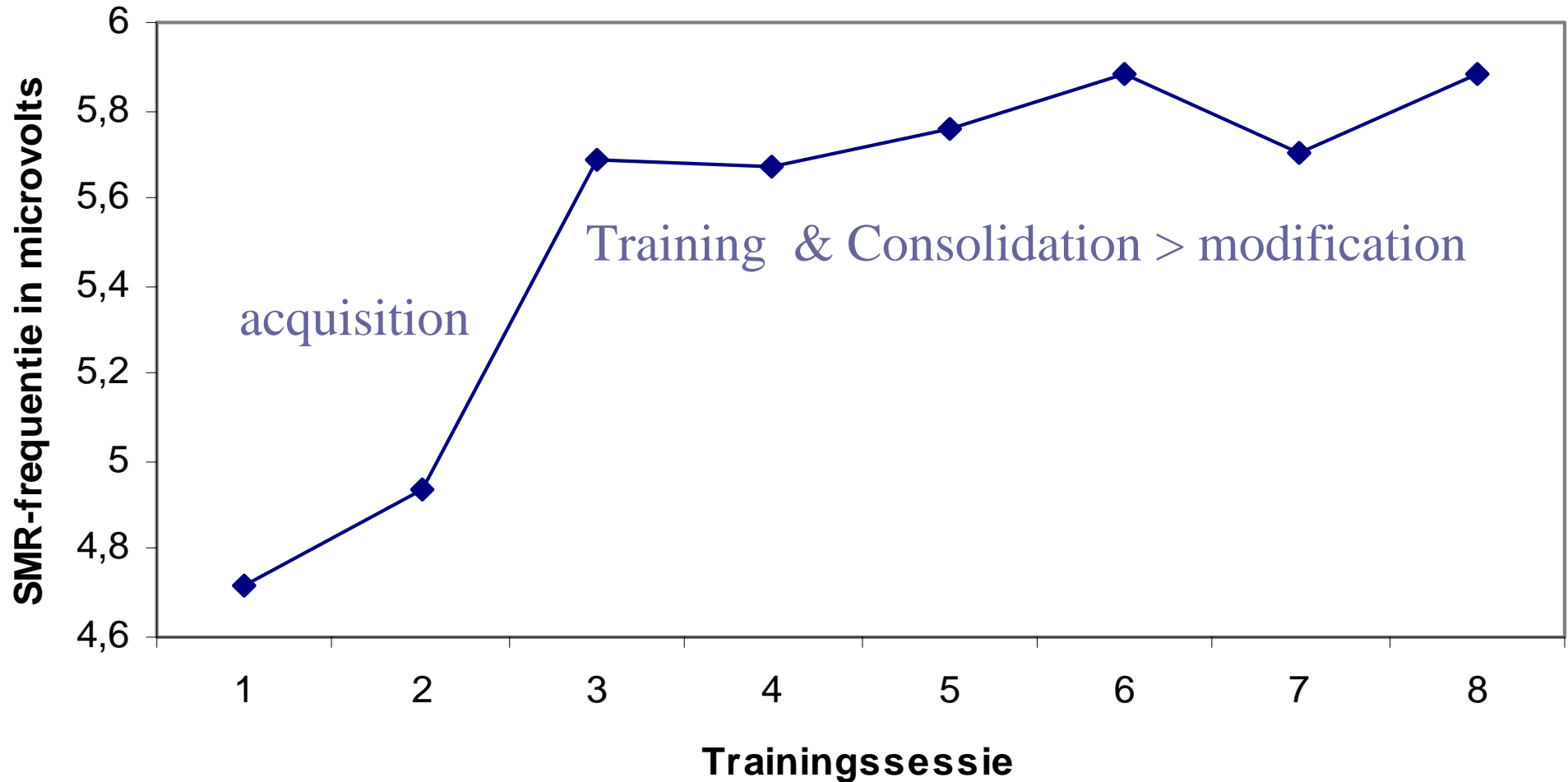
One-way ANOVA "treatment" for NOGO at Fz (280-420ms)
 $F(1,18)=4.04, p<0.5$

Discussion

- Why **CPT** ns ? Impulsivity: preprogrammed action **dorsolateral** circuitry
 - Why **AntiSaccade** ns ? Impulsivity: genetically determined action **dorsolateral** circuitry
 - Why **Stroop** sign ? Impulsivity: learned action **ventrolateral/ ventromedial** circuitry
- But: Stroop with Tempo factor (200 vs 2000 msec) sign. decrease in interference with low tempo (sustained attention)
- **Ventrolateral/ ventromedial** circuitry more sensitive to NfB ?
 - Beauregard / Levesque reported changes in ACG after NfB (fMRI)
 - Stroop associated with ACG (Bush)
 - **NEUROFEEDBACK EFFECTIVE ?**

Mean amplitude over sessions

$F(1,7)=5,0$, $p=0,056$



Measures

Continuous Performance Task (A-X-CPT)

gedragsinhibitie

(20 minuten)

3 sessies met de volgende combinatie van cues en probes

cue: probe:

A X 80 Target trials

A niet X 20 Nontarget trials

niet A niet X 20 Nontarget trials

niet A X 20 Nontarget trials

Measures

Stroop (interference inhibition)

(20 min)

Task: name color :

A:

RED

B:

RED

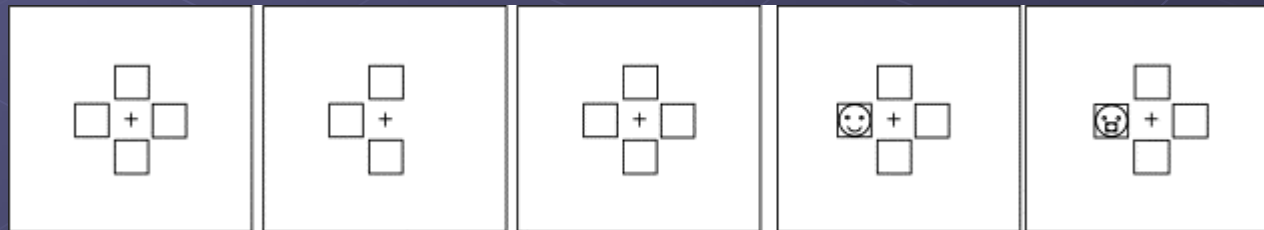
Difference in 'namingtime' between A and B is measure of interference

Measures

Antisaccade task (45 min) **oculomotoric inhibition**

Cues: procue (cue & target in same box)
anticue (cue & target in opposite boxes)
central condition without cue

Targets ☹️
😊
after a short interval the mouth is hidden



Measures

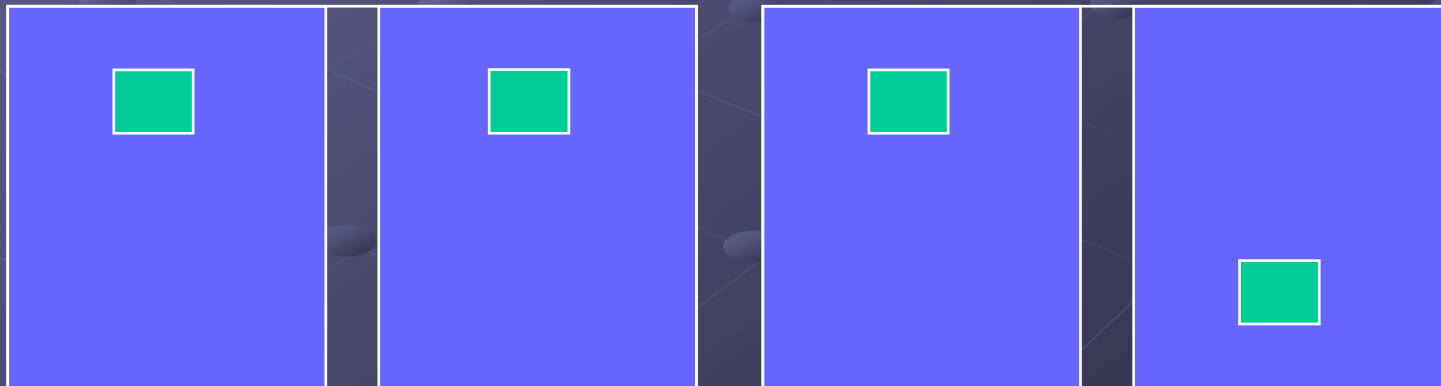
G0-Nogo Task

behavioral inhibition

Two conditions:

A

B



Go

Nogo