Biomarker report

HBimed
Brain Diagnostics

Client name:	Ano Nymous,
	04.01.1995, m
Recording date:	06.01.2026
Order from:	
Rationale:	Assessment
Date Report:	20.01.2026

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Report summary

Conclusion:

The psychological assessment does not support a diagnosis of ADHD. ADHD questionnaire scores do not meet diagnostic cut-offs, and childhood ADHD criteria are not fulfilled on the Wender–Utah Rating Scale, failing DSM-5 requirements. Although isolated attentional symptoms are present, the overall pattern is subclinical. Depressive and anxiety symptoms are minimal; however, subjective distress is elevated. Additional findings include hypomanic traits, high sensitivity, panic symptoms, and sleep disturbances, with preserved overall functioning and life satisfaction. The clinical picture is inconsistent with ADHD and more suggestive of affective and anxiety-related dysregulation.

EEG/QEEG findings show preserved global brain function, including a symmetrical posterior dominant alpha rhythm (9.8 Hz) with normal reactivity, indicating intact cortical and thalamo-cortical function. Abnormal frontal alpha dominance suggests functional underactivation of frontal executive networks, consistent with reduced top-down control, motivational flattening, and cognitive fatigue. Intermittent focal theta–delta activity in bilateral fronto-temporal regions reflects state-dependent limbic and emotional dysregulation rather than structural pathology. Sharp alpha–delta complexes in the right temporal region indicate heightened affective sensitivity with rapid inhibitory disengagement.

sLORETA analysis demonstrates involvement of distributed fronto-parietal and temporo-parietal networks (BA 6, 9, 7, 19, 31, 22), associated with executive control, attentional regulation, sensory integration, and self-referential processing. These findings are non-specific and should be interpreted in conjunction with clinical data.

VCPT performance is within normal limits for attention, impulsivity, reaction time, and response consistency. Reaction time is stable and slightly faster than normative means, possibly reflecting mild impulsivity or training effects. Error patterns suggest initial task engagement difficulties, followed by stable performance and later fatigue-related decline in sustained attention.

ERP findings indicate efficient sensory processing combined with high emotional sensitivity, sustained activation, strong monitoring tendencies, and limited downregulation. This pattern reflects heightened internal load, emotional reactivity, and vulnerability to stress and mental fatigue, without evidence of epileptiform activity, diffuse encephalopathy, or neurodegenerative pathology.

The findings do not support a diagnosis of ADHD or ASD. The clinical and neurophysiological profile is most consistent with affective and anxiety-related dysregulation with high emotional sensitivity, fluctuating arousal, and stress-related executive inhibition. The observed attentional and executive symptoms are best understood as secondary to emotional and autonomic regulation difficulties rather than a primary neurodevelopmental disorder.

Treatment should focus on emotion regulation, stress management, and improving sleep, using therapy to increase flexibility and prevent overload.

Findings (the findings are continually explained throughout the report)

Questionnaires (see page **Error! Bookmark not defined.**):

General answer to the questionnaire reply: When analyzing the answers, the observer position must always be taken into account. Life arises in an interdependence with itself and the environment. That is, observations are always to be evaluated as subjective constructions of everyday life. The perception of health and suffering is also assessed subjectively.

- **ADHD Questionnaire:** Ano Nymous does not meet the cut-off (5 criteria) either for inattention nor hyperactivity. This means that with a high probability the diagnosis of ADHD does not apply to Ano Nymous.
- **Depression questionnaire:** The BDI-II final score for Ano Nymous is 10 – minimal depression (clinically not relevant).
- **Anxiety questionnaire:** The BAI final score for Ano Nymous is 2 – minimal anxiety.
- **Everyday strategies questionnaire:** The answers do not show any significant values regarding temporal lobes, prefrontal cortex and deep limbic system for Ano Nymous. The basal ganglia and cingulate cortex show a (slightly) high level of strain. The self-rated distress is quite high and therefore clinically relevant.
- **Wender-Utah-Rating-Scale (WURS-k):** For Ano Nymous, the results of the Wender Utah Rating Scale indicating ADHD during infancy are not statistically significant. According to DSM 5, ADHD can be diagnosed under these circumstances, provided that there has been evidence for this disorder since childhood. This is the case for Ano Nymous.
- **Symptom Checklist-90 by Derogatis, Eich, Gamma:** For Ano Nymous, the scales Obsession-compulsion, Anxiety and ADHD scale are within the abnormal range.
- **Summary areas of life:** No area of life is determined to be abnormal. Health state is determined not abnormal.
- **Comorbidities:** The following comorbidities have been stated for Ano Nymous: Panic disorder and Sleeping disorders.
- **Hypomania Checklist (HCL-32 R2):** The overall results for Ano Nymous suggest hypomania. Hypomanic symptoms mainly exist in factor "active/elated" (17/19).
- **Sensitivity questionnaire for adults:** The overall results indicate that the subject of high sensitivity for Ano Nymous is significant. Additionally, questions with extreme answers justify the hypothesis of a probable highly sensitive feeling.
- **Kessler Psychological Distress Scale (K10):** The final score is - 16–21. This is moderate psychological distress. Under 20: Likely to be well.
- **Life Satisfaction Questionnaire (FLZ):** Summary areas of life: No area of life is determined to be abnormal. Health state is determined not abnormal.
- **Hypomania Checklist (HCL-32 R2):** The overall results for Ano Nymous suggest hypomania. Hypomanic symptoms mainly exist in factor "active/elated" (17/19).

Performance (see page ff):

- **VCPT:** The values of Ano Nymous are within the norm with respect to Attention, Impulsivity, Reaction time and Response consistency.

The analysis of Ano Nymous's reaction times compared to peers (green area) shows a good consistency in reaction time.

The average reaction time is comparable to that of peers (green dot). Reaction time is faster than the normative means, which may be associated with mild impulsivity or, alternatively, with training effects such as experience with video games or activities requiring rapid responses (e.g., programming).
There are only few errors throughout the entire test.
This pattern suggests initial omission errors reflecting delayed engagement with the task, followed by commission errors, which may indicate impulsive responding during the early adjustment phase. Performance then reached a plateau, reflecting stable and effective task engagement. Toward the end of the 22-minute test, omission errors increased again, consistent with fatigue and a decline in sustained attention over time.

Functional Neurophysiology: (see page **Error! Bookmark not defined.** (Spectra) and page **Error! Bookmark not defined.** (evoked potential):

- **Spectral analysis**:

Eyes open: Increased relative theta power frequency in the right temporal area T3
Increased relative alpha power spectra in the prefrontal Fp1, Fp2, frontal F7, F3, Fz, F4, F8, temporal T3, T4, T5, central C3, Cz, C4, parietal P3, Pz, P4, occipital O1, O2 areas

Eyes closed: Increased relative theta power frequency in the prefrontal Fp1, Fp2, frontal F4, F8, temporal area T3, T5, central C3, parietal P3 areas
Increased relative alpha power spectra in the prefrontal Fp1, Fp2, frontal F7, F3, Fz, F4, F8, temporal T4, parietal P3, Pz, P4 areas

VCPT: Increased relative theta power frequency in the frontal F7, temporal area T3, T4, T5, T6, central C4 areas
Increased relative alpha power spectra in the prefrontal Fp1, Fp2, frontal F7, F3, Fz, F4, F8, parietal P3, Pz, P4, occipital O1, O2 areas
Index of inattention: Theta Beta ratio increased

Asymmetry: Significant asymmetry in the temporal, central, temporal-parietal areas

sLoreta:

Brodman area 9 (Middle Frontal Gyrus, Frontal Lobe)
Brodman area 31 (Precuneus, Frontal Lobe)
Brodman area 19 (Precuneus, Parietal Lobe)
Brodman area 7 (Precuneus, Parietal Lobe)
Brodman area 6 (Sub-Gyral, Frontal Lobe)
Brodman area 22 (Superior Temporal Gyrus, Temporal Lobe)

- **Arousal, inner excitement***:*

Arousal depending on the ability to focus:

Compared with peers, Ano Nymous shows in all conditions significantly reduced values. These values indicate significantly lower activation. This often leads to a lack of motivation and a lowered willingness towards effort. In unsecure situations, Ano Nymous might express fears and misgivings. One observes depressive mood

modulation as well as significant unreal perception of everyday life. Often, compensation is sought through external stimulation (gaming, other excessive behaviors). This behavior yields a bearable internal level of activation. Reduced activation often leads to loss of focus.

- **Evoked potentials**:

P1/N1 – Visual Input
Mid potential shows short latencies and high amplitudes, indicating fast, intense, and highly sensitive visual processing. This reflects efficient visual decoding with a tendency toward hypersensitivity under limited suppression.
P1/N1 vTR – Right Association Areas
High mid-potential amplitudes indicate strong sensory–cognitive integration and sustained attention with a holistic and emotionally oriented processing style. This is associated with intense emotional involvement.
V com TL – Left Memory Areas
Long-lasting high late-potential amplitudes reflect intense monitoring, comparison, and control processes during retrieval. This pattern is associated with meticulous, overcontrolled behavior and exhaustion. An unusual curve progression suggests the need for further assessment of left-sided memory functions.
P3b – Activation Operation
Prolonged high late amplitudes indicate strong tonic and phasic activation, reflecting high internal involvement and sustained cortical readiness, often linked to emotional load and overactivation.
P3a – Inhibition / Suppression
Reactivation of late inhibition potentials suggests inefficient selection and decision-making, with increased emotionally influenced monitoring demands.
P4wmF – Working Memory
Dorsolateral prefrontal activation indicates strong coupling of working memory and emotional regulation, increasing susceptibility to emotional interference.
SW PHC – Parahippocampal Activity
Rhythmic slow activity reflects heightened limbic involvement and emotional memory processing.
CNV – Readiness Potential
Elevated mid-potential amplitudes indicate intense preparatory activation and heightened expectancy for upcoming stimuli.

Overall: The ERP profile demonstrates efficient sensory processing combined with high emotional sensitivity, sustained activation, and overcontrol, resulting in vulnerability to emotional overload, decision-making inefficiency, and fatigue, without evidence of structural pathology.

Diagnostic-Algorithms:

The following indices have been developed in several studies as follows: A variety of neurobiological variables are research-related in a classification process. The classification process then refers to the comparison of two large samples (at least 80, eg 80 ADHD and 80 healthy) and tries to classify the two groups by means of the variables. A number of variables are combined with each other until the best possible separation of the groups results. From this classification process, a so-called classifier is then developed, via which the data of the individual patient are compared with the output data. Positive results mean that the data of the patient are similar

to the data of the research group, negative results indicate that the data of the patient does not correspond to the research group.

The calculation of the indexes for Ano Nymous resulted in the following:

ADHD-Index: ADHD –probability ADHD**: 12%** - No significant match

ST1: 18% - No match with dysfunctional ADHD networks
ST2: 22% - No match with dysfunctional ADHD networks
ST3: 13% - No match with dysfunctional ADHD networks
ST3 (ST1vsST3): 44% - Increased match with dysfunctional networks of the prefrontal cortex (vs. limbic system)

Subtype 1: Emotional regulation
Subtype 2: Cingulary Cortex (adaptation)/arousal)
Subtype 3: Attention/executive functions

Treatment algorithms:

The treatment algorithms are calculated in the same way as the diagnostic algorithms. The basis is provided by groups of patients who were interviewed over a period of 12 months, monthly with regard to the effect of the drug. The neurophysiological measurements of patients with good responder quality are compared with the group of patients who gave negative feedback. In addition, the neurophysiological measurements of both the good responders and the bad responders are compared with the measurements of the healthy control subjects.

Restriction: Publication of the investigation has been partial. **The responsibility for the medication remains with the prescribing physician.**

Recommendations: (see also at the end of the report)

The recommendations are based on the available data (interviews, questionnaires, neuropsychological examinations, brain functions). I am aware that this is a limited spectrum. Nevertheless, I would like to point out that any planning of measures and the resulting support for Ano Nymous must be holistic and include various aspects of life. In addition to the social network, this includes the consideration of thinking, acting and feeling as well as the biological aspects. How the change is made can not be defined in this report. However, we think it makes sense to operate according to the difficulties through a multimodal approach that takes into account both the person and social network aspects.

The following areas are recommended at the end of the report:

- Everyday Strategies/School (See page **Error! Bookmark not defined.**2)
- Medication (see page. **Error! Bookmark not defined.**3):
- Additional recommendations (see page. 3)

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I. Introduction

Important notice: qEEG and potential assessment do not replace a medical-clinical checkup. They solely serve to generate comparable physiological data in different cognitive states. No neurologic diagnostic statement will be made. A neurologic assessment must be done by a licensed Neurologist.

Procedure: EEG recording was computed according to the 10-20 placement using 19 scalp electrode caps. Brain electrical activity was digitally recorded on a Mitsar EEG 201 System, using a linked ears reference montage. Impedances of less than 5k Ohms were achieved at all sites before recordings were initiated and kept >5k Ohms at all times during recording. The signal was digitally processed by a quantitative topographic analysis system (Mitsar software), band passed from 1-50Hz, and saved on a local disc.

The client was seated 1.5m in front of a display monitor. The EEG was recorded in relaxed condition with eyes closed (EC) and eyes opened (EO) for 5 Minutes each and saved. After a short break, a visual or auditory continuous performance task (ACPT/VCPT) was presented on the monitor and performed during recording (task condition). The data was saved separately.

The digitized data is run through an artifact program where eye blinks, movement and other artifacts are identified and removed. The data is then additionally manually processed for artifacts and important transients are marked.

Corrected digital recording of the client is run through a mathematical program called Fourier-Transformation. This procedure analyzes the recorded brain waves and expresses the recordings as a mathematical function - time as a function of frequency - known as its frequency spectrum. To evaluate the data there are diverse descriptive and statistical repetitions which are performed to provide a spectral analysis, topometric analysis, covariance analysis, and comparisons between the states of data acquisition. The data collected is compared and evaluated against a known FDA approved data base.

This report aims to present the results and conclusion of this analysis. Also therapeutic recommendations are given, according to dysfunction and cortical organization of the client's brain. Presented results are to be handled with caution, as they represent a momentary picture of a whole complex system.

The graphs represent an approximation of the source generator in the cortex calculated through mathematical procedures. Hence the calculated localization can differ from the real source. Therefore, expert knowledge based on functional neuronal models should ultimately determine the clinical relevance of these findings.

II. Questionnaires

1. Questionaire: Personal and clinical data

General information

- Name (family name, given name) or code: **Ano Nymous**
- Date of birth (Day. Month. Year): **04. 01. 1995**
- Gender (M-male, F-female): **M**
- Handed (L- left, R – right, ambidextrous): **R**
- Reason of having QEEG/ERP assessment: **Routine**
- Medication taken now: **None**

Pre- and post-natal history

- Poor grades in school, poor performance at work: **Poor performance in school**

General Brain Regulation

- Often having headaches and/or migraines: **None**
- Feels weak and passive during daytime: **Sometimes**
- Sleep-related difficulties: **Sometimes**
- Abuses alcohol or drugs: **None**
- Has history of seizures: **None**

Sensory system

- Perceptual difficulties in vision, hearing, touch…such as dyslexia, paresis, neglect…: **None**
- Difficulties in social interaction and communication, autistic spectrum: **Slightly**

Motor system

- Motor-related difficulties, such as fine motor, tremor, rigidity, apraxia…: **None**

Executive system

- Attention difficulties: **Struggle to focus on tasks I do not find interesting or engaging. Tendency to get easily distracted.**
- Impulsiveness: **Quick to start projects and buy materials for them, then not finish the project. Generally poor impulse control, needed to block some websites on home network to keep myself from going to them.**
- Difficulties in correcting behavior: **None**
- Psychosis (hallucinations, delusions…): **None**

Affective system

- Occupied by mostly positive thoughts, manic: **Actively trying to be positive, tend to see opportunities more than challenges.**
- Occupied by mostly negative emotions, depressed: **Frequently anxious about the way the world is developing, and my future within it.**
- Anxious: **See above**

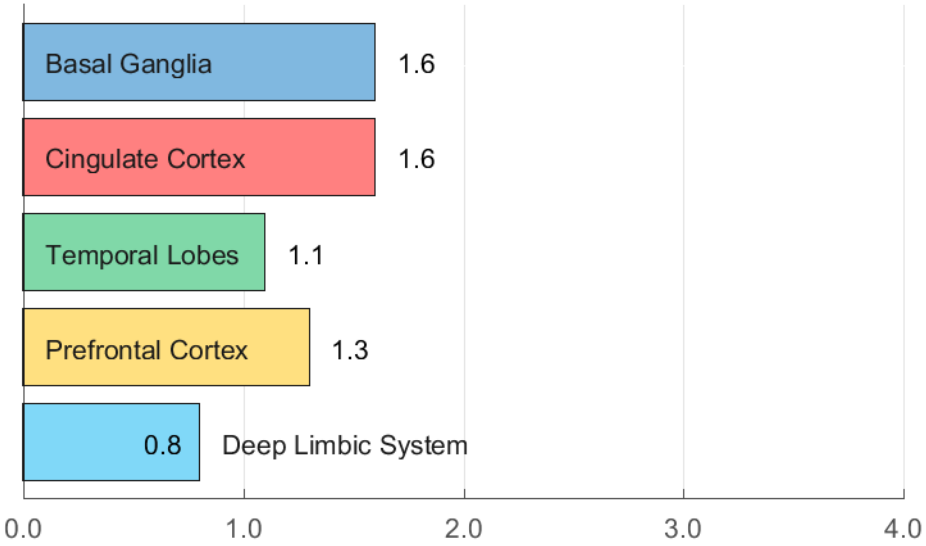
Memory system

- Poor memory for recent events: **None**
- Other forms of memory deficit: **None**

2. Questionnaire: Symptoms and Cortical Networks (Amen)

The relations between answers to the questions of the everyday functioning questionnaire and different brain structures have been researched. The figure below shows the weight of stressors on each structure. As answering styles are highly variable between individuals, it cannot be stated if the stressor is significantly impairing everyday functioning or not. Nonetheless it is interesting to observe the differences between various structures.

Graphic summary:



The answers do not show any significant values regarding temporal lobes, prefrontal cortex and deep limbic system for Ano Nymous. The basal ganglia and cingulate cortex show a (slightly) high level of strain. The self-rated distress is quite high and therefore clinically relevant.

- The strain on the Basal ganglia is defined by the influence of the vegetative nervous system. This includes somatic symptoms like palpitations, sweaty hands, or stomach pain; also anxiety reactions like panic attacks, or fear of negative evaluations of others. These processes are assessed in our measurement by analyzing the experience and feeling of stress.

- The cingulate system goes from the frontal cortex (anterior part) over the medial cingulate cortex and to the posterior cingulate cortex (precuneus). Functions are affected by cognitive and emotional contents. In this context monitoring functions are required, like internal flexibility (vs rigidity). Dysfunctions of the cingulate system influence all other cortical areas. The serotonin system is widespread

along the cingulate cortex. The cingulate system receives information from the thalamic anterior nuclei.

Symptoms rated 'frequently' (3) and 'very frequently' (4):

- Conflict avoidance (3)
- Excessive fear of being judged or scrutinized by others (3)
- Low motivation (3)
- Excessive motivation (3)
- Tics (motor or vocal) (3)
- Quick to startle (3)
- Lack of confidence in your abilities (3)
- Trouble shifting attention from subject to subject (4)
- Trouble shifting from one task to another (4)
- Tendency to predict fear (3)
- Short fuse or periods of extreme irritability (3)
- Excessive daydreaming (3)

3. ADHD-Questionnaire

Type	Question	Score
Type 1	**Combined ADHD-Type** → *Questions on Attention & Hyperactivity* Meets criteria for *Inattentiveness* questions as well as *Hyperactivity-/ Impulsivity* questions.	5
	Inattentiveness Questions → *Questions on Attention* 6 (5) or more values of 3 or 4 are required to diagnose this type; with more than 4 values suspect this type of ADD.	3
	Hyperactivity-/Impulsivity Questions → *Questions on Hyperactivity* 6 (5) or more values of 3 or 4 are required to diagnose this type; with more than 4 values suspect this type of ADD.	2
Type 2	**Inattentive ADD** → *Questions on Attention* 6 (5) or more values of 3 or 4 are required to diagnose this type; with more than 4 values suspect this subtype of ADD; but not 6 or more ratings for *Hyperactivity-/Impulsivity* questions.	3
Type 3	**Over focussed ADD** → *Questions on Over Focusing* Meets criteria for *Inattentiveness*, as well as 6 or more values in *Over Focusing* questions.	1
Type 4	**Emotion regulation Comorbidity** → *Questions on Emotion regulation* Meets criteria for *Inattentiveness*, as well as 12 or more values in *Emotion regulation* questions.	3

The psychological evaluation does not support a clear diagnosis of ADHD. ADHD questionnaire scores do not meet established diagnostic cut-offs. It should be noted that this instrument is designed for children and is therefore of limited validity for a 31-year-old adult. The Type 1 score of 5 lies at the upper end of the normative range.
Although isolated symptoms are present, the overall pattern does not support a definitive ADHD diagnosis. Subclinical attentional symptoms are observed and should be further evaluated using age-appropriate, adult-specific assessment instruments..

Summary of high and very high rated behaviors (● Attention, ● Hyperactivity/Impulsivity, ● Emotion regulation und ● Over Focusing):

- ● struggles to keep order (room, table, school bag, filing cabinets, etc.) (3)
- ● has difficulty with time, is often too late or in a hurry, tasks take longer than expected, projects or assignments are done in the last moment / too late (3)
- ● avoids or is reluctant or unwilling to do work that requires prolonged mental effort (such as schoolwork or homework or for teenagers and adults: report writing, filling out forms, checking of longer reports) (3)
- ● fidgets with hands or feet or squirms in the chair (4)
- ● is often restless, in situations when remaining seated is expected (leaves his seat in the classroom, in the workplace) (3)
- ● seems anxious or fearful (3)
- ● cannot fall asleep, wakes up during the night, shows irregular sleeping behavior (3)

- thinks quickly, his brain speeds much faster than he can speak or others can follow (3)
- struggles to shift attention from one thing to another (3)

4. ADHB-SB:

The patient meets the criteria for ADHD diagnosis according to DSM-IV.

- During work or other activities (e.g. reading, watching TV, playing) I have difficulties concentrating for a long time.
- I prefer avoiding tasks that imply some kind of mental effort. I do not like those kinds of tasks or I inner-ly resist myself against them.
- I get distracted very easily while I am working.
- It is hard for me to work in silence. When I am occupied with something I am quite loud and noisy.
- I am permanently on the move and feel like I am driven by a motor.
- I have had the problems listed on this questionnaire since school age.
- I have the problems listed on this questionnaire not solely during work but also in other situations: e.g. family, friends, leisure time.

- I am kind of twitchy/fidgety.
- I have trouble staying seating for a long time (e.g. in cinema, theater).

5. Wender-Utah-Rating-Scale (WURS-k):

The Wender-Utah-Rating Scale provides information about attention and hyperactivity problems during childhood (before age 12). Social relations during school time are also enquired. The analysis of the answers provided shows the following results:

For Ano Nymous, the results of the Wender Utah Rating Scale indicating ADHD during infancy are not statistically significant.

The following attributes have been reported as considerably pronounced:

- As a child of 8-10 years I had problems concentrating and was easily distracted
- As a child of 8-10 years I was active, restless, always on the go
- As a child of 8-10 years I was inattentive and daydreamy
- As a child of 8-10 years I had trouble with stick-to-it-tiveness, not following through, failing to finish things that were started
- As a child of 8-10 years I was stubborn and strong-willed
- As a child of 8-10 years I had a tendency to be immature

6. Depression questions BDI-II

BDI-II (Beck Depression Inventory) is a clinical questionnaire measuring severity of depression. The final score for Ano Nymous is **10 - minimal depression (clinically not relevant).**
List of all affected items:

- Pessimism - *I feel more discouraged about my future than I used to be.*
- Past Failure - *I have failed more than I shoud have.*
- Self-Dislike - *I have lost confidence in myself.*
- Self-Criticalness - *I am more critical of myself than I used to be.*
- Worthlessness - *I don't consider myself as worthwhile and useful as I used to.*
- Loss of Energy - *I have less energy than I used to have.*
- Changes in Sleeping Pattern - *I sleep a lot more than usual.*
- Concentration Difficulty - *I can't concentrate as well as usual.*

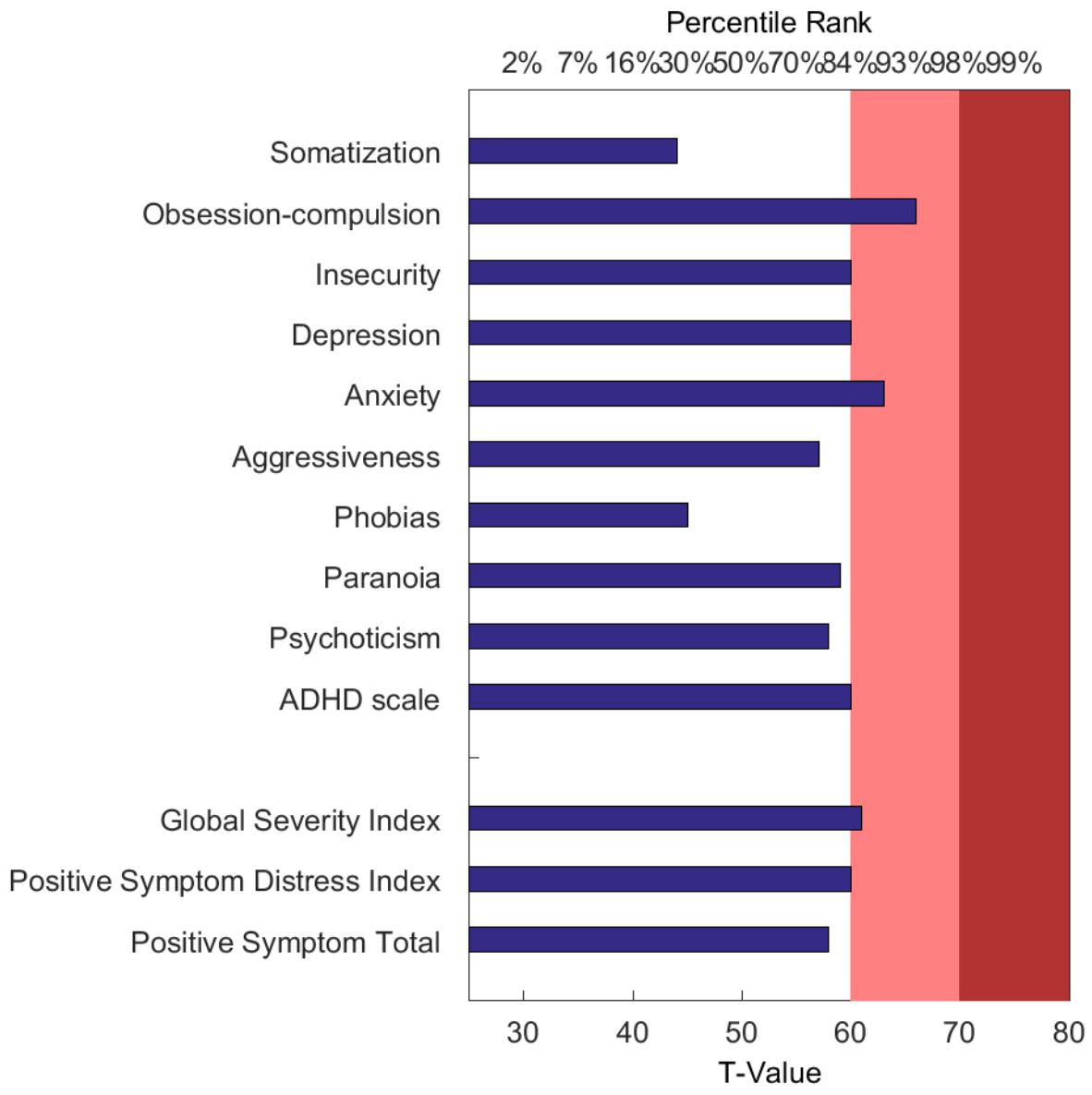
7. Anxiety questions BAI

BAI (Beck Anxiety Inventory) is a self-report measure of Anxiety. The final score for Ano Nymous is **2 - minimal anxiety.**
List of affected items:

- Incapable of relaxing - *mildly*
- Restless - *mildly*

8. SCL90 – Fragebogen

SCL-90®-S measures self-rated somatic and psychological problems during the last week. This rating scale is one of the most widely used self-rating scales to register psychological strain.



Summary of Symptom Checklist-90 by Derogatis, Eich, Gamma: For Ano Nymous, the scales Obsession-compulsion, Anxiety and ADHD scale are within the abnormal range.

The following Scales are statistically significant:

- The SCL90-Scale "Obsession-compulsion" is slightly statistically significant. People who score high in this scale suffer from recurring thoughts, word or ideas they can't get out of their mind, memory issues,

agitation due to forgetfulness and inattentiveness, feeling that they have difficulties to start anything, a need of doing everything in a slow and retarded manner to ensure that everything is done well and then the compulsion to check and double check everything they do; difficulties to make decisions, an empty head, attention problems or compulsions to repeat actions like touching, counting or washing.

- The SCL90-Scale "Insecurity" is slightly statistically significant. People who score high in this scale suffer from overly criticism to others, shyness or clumsiness towards the opposite sex; vulnerable feelings, feeling that others don't understand them or are unsympathetic, that others are unfriendly or cannot stand them; a sense of inferiority, feeling uneasy when people observe or talk about them; strong prejudices interacting with others or feeling uncomfortable when eating or drinking in public.
- The SCL90-Scale "Depression" is slightly statistically significant. People with overly high values suffer from decrease in their interest or pleasure in sex, loss of energy or slowing down of their movements or thoughts; they have suicidal thoughts, cry easily, are afraid of being caught, self-reproach, feelings of loneliness, melancholy, worries, lack of interest, despair about the future, that everything is exhausting or feeling of being worthless.
- The SCL90-Scale "Anxiety" is slightly statistically significant. People with high scores in this scale suffer from nervousness or inner trembling, shaking, sudden fright without good reason, fear, heart beats or heart racing, feeling tense or excited, panic attacks, extreme restlessness that unables them to sit still, constantly feeling that something bad will happen or horrible thoughts and visions.
- The ADHD-Scale is statistically significant. People with high scores in this ADHD scale show noticeable problems related to impulse control and regulation. According to the included items, problems such as nervousness without inner trembling, irritability towards emotionally loaded questions, emotional releases or feelings of restlessness or tension. Sometimes they are unable to start tasks due to internal blockade. Some people with this profile frequently engage in conflicts with others which is perceived as distressing.
- The SCL90-Scale "Global Severity Index" is slightly statistically significant. The GSI (Global Severity Index) measures overall psychological distress level.
- The SCL90-Scale "Positive Symptom Distress Index" is slightly statistically significant. The PSDI (Positive Symptom Distress Index) measures the intensity of symptoms and informs about the level of distress.

9. Kessler Psychological Distress Scale (K10):

This is a 10-item questionnaire measuring emotional distress over the past 30 days, with scores ranging from 10 to 50. Each item is rated 1-5 ("None of the time" to "All of the time"). A score of 10-15 indicates low/no distress, 16-21 moderate, 22-29 high, and 30-50 very high distress.

The final score of Kessler Psychological Distress Scale (K10) for Ano is - **16–21:** Moderate psychological distress. **Under 20**: Likely to be well.

10. Life Satisfaction Questionnaire (FLZ):

Summary areas of life: No area of life is determined to be abnormal. Health state is determined not abnormal.

11. Psychiatric disorders in the family

	Child(ren)	Siblings	Mother	Father	Other	Unknown
ADHD				x		
Other attention deficit or hyperkinetic disorders						x
Social behavior disorder						x
Autism				x		
Asperger						x
Tic disorder						x
Depression						x
Bipolar (manic-depressive) disorder						x
Anxiety disorder						x
Panic disorder						x
Agoraphobia						x
Social phobia						x
Specific phobia						x
Obsessive-compulsive disorder						x
Sleep disorders						x
Eating disorder						x
Schizophrenia / psychosis						x
Borderline personality disorder						x
Alcohol abuse						x
Drug abuse						x
Suicidal tendencies						x
Epilepsy						x

12. Hypomania Checklist (HCL-32 R2):

The "Hypomania Checklist (HCL-32 R2)" is a self-rating questionnaire for a lifetime history of hypomanic symptoms. The second revision (R2) is taken from the work by Angst, 2013.

Over a lifetime every human being experienced significant changes in energy, activity, and mood, such as lows (sadness, loss, bereavement) and highs (romantic love, personal success, and achievement) of shorter (hours, days) or longer (weeks, months) duration. There is a continuum from normal lows and highs to clinically relevant depression/melancholia and hypomania/mania.

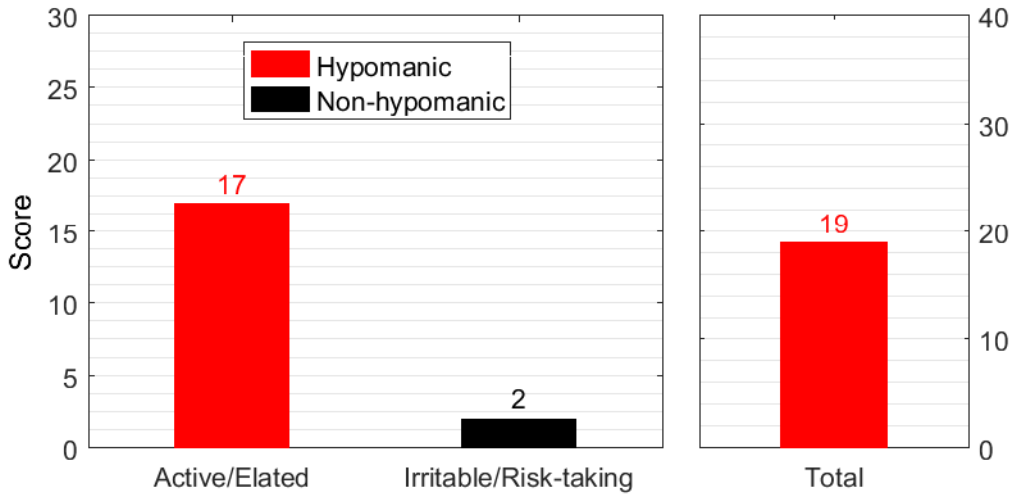
In clinical practice, hypomanic symptoms are often not identified because they are either not experienced or not recognized as abnormal by the individual and therefore are not spontaneously reported. Therefore, many patients diagnosed as unipolar depressives may have an unrecognized bipolar disorder. Identifying these "hidden" bipolar cases is important to ensure proper, effective treatment.

The following information is extracted from the "Hypomania Checklist (HCL-32 R2)".

Section 1	**Subject's current condition**	*Better than usual*
Section 2	**Subject's usual energy**	*Again, and again characterized by clear fluctuations up and down*

Section 3 - Subject's description of the past "highs":

This picture shows the total results and two factors.



The factor "active/elated" relates to the more positive symptoms of hypomania, including elevated mood and activity. The factor "irritable/risk-taking" relates to the more negative symptoms, including irritability and impatience. The cutoff for factor "active/elated", "irritable/risk-taking" and total score is 14, 5 and 14,

respectively. The HCL-32 R2 has been reported to have a sensitivity of 82% and a specificity of 73% (Angst, 2013).

Section 4	**Effects of "highs" in subject's life**	Family	*No consequences*
		Friends and acquaintances	*No consequences*
		Job	*Positive and negative*
		Leisure	*Positive and negative*

Section 5	**Reactions of others to subject's "highs"**	*Positive (e.g. supportive, encouraging)*
Section 6	**Duration of "highs"**	*More than 1 week*
Section 7	**Any "highs" over the past 12 months?**	*Yes*
Section 8	**How many days of "highs" in the past 12 months?**	*120*

Total score is: 19.

The overall results for Ano Nymous suggest hypomania. Hypomanic symptoms mainly exist in factor "active/elated" (17/19).

13. Sensitivity questionnaire for adults:

The “Sensitivity questionnaire for adults”—specifically designed to investigate the level of sensitivity—comes from the book by Elaine A. Aron. The questionnaire is intended to help understand behavior, thinking and feeling better.

If twelve or more of the statements were answered with "yes" (answers: “often” or “very often”), the subject of high sensitivity is likely to matter. However, no psychological test is so precise that high sensitivity can be geared to this result alone. If only 4 or 5 of the above statements apply, but to an extreme extent (answer: "very often"), it can also be justified to describe the subject of high sensitivity as significant.

The following statements have been reported to their extreme extent, which may imply a sensitive condition:

- Item 1: It seems to me that I perceive subtleties around me.
- Item 6: Loud noises make me feel uncomfortable.
- Item 7: Art and music can move me deeply.
- Item 13: It annoys me a lot when I am asked to do several things at the same time.
- Item 14: I get nervous when I have a lot to do in a short time.
- Item 22: It is one of my absolute priorities to organize my daily life so that I can deal with exciting situations or avoid those that overwhelm me.

Total score is: 14.

The overall results indicate that the subject of high sensitivity for Ano Nymous is significant.

Additionally, questions with extreme answers justify the hypothesis of a probable highly sensitive feeling.

14. Questionnaire summary:

Background Information: questionnaires are subjective ratings whereas individual values and interpretations of facts have to be taken into account.

General answer to the questionnaire reply: When analyzing the answers, the observer position must al-ways be taken into account. Life arises in an interdependence with itself and with the environment. That is, the observations are always to be evaluated as subjective constructions of everyday life. The percep-tion of health and suffering is also assessed subjectively.

ADHD Questionnaire: The psychological evaluation does not support a clear diagnosis of ADHD. ADHD questionnaire scores do not meet established diagnostic cut-offs. It should be noted that this instrument is designed for children and is therefore of limited validity for a 31-year-old adult. The Type 1 score of 5 lies at the upper end of the normative range.

Although isolated symptoms are present, the overall pattern does not support a definitive ADHD diagnosis. Subclinical attentional symptoms are observed and should be further evaluated using age-appropriate, adult-specific assessment instruments.

ADHB-SB: the patient meets the criteria for ADHD diagnosis according **to DSM-IV.**

Wender-Utah-Rating-Scale (WURS-k): the results of the Wender Utah Rating Scale indicating ADHD during infancy are not statistically significant. According to DSM 5, ADHD can be diagnosed under these circumstances, provided that there has been evidence for this disorder since childhood. Although several childhood behaviors associated with attentional and activity regulation were retrospectively endorsed, the WURS-k total score was not statistically significant. Therefore, these findings do not provide sufficient evidence of clinically relevant ADHD symptoms in childhood and do not support suspicion of ADD/ADHD according to DSM-5 criteria.

Depression questionnaire: The BDI-II final score is 10 – minimal depression (clinically not relevant).

Anxiety questionnaire: The BAI final score is 2 – minimal anxiety.

Everyday strategies questionnaire: The answers do not show any significant values regarding temporal lobes, prefrontal cortex and deep limbic system. The basal ganglia and cingulate cortex show a (slightly) high level of strain. The self-rated distress is quite high and therefore clinically relevant.

Symptom Checklist-90 by Derogatis, Eich, Gamma: the scales Obsession-compulsion, Anxiety and ADHD scale are within the abnormal range.

Summary areas of life: No area of life is determined to be abnormal. Health state is determined not abnormal.

Comorbidities: The following comorbidities have been stated: Panic disorder and Sleeping disorders.

Psychiatric disorders in the family: father – ADHD, AASD

Hypomania Checklist (HCL-32 R2): The overall results suggest hypomania. Hypomanic symptoms mainly exist in factor "active/elated" (17/19).

Sensitivity questionnaire for adults: The overall results indicate that the subject of high sensitivity is significant. Additionally, questions with extreme answers justify the hypothesis of a probable highly sensitive feeling.

Kessler Psychological Distress Scale (K10): The final score is - 16–21. This is moderate psychologi-cal distress. Under 20: Likely to be well.

Life Satisfaction Questionnaire (FLZ): Summary areas of life: No area of life is determined to be abnormal. Health state is determined not abnormal.

Hypomania Checklist (HCL-32 R2): The overall results suggest hypomania. Hypomanic symptoms mainly exist in factor "active/elated" (17/19).

III. Summary of results (Performance, qEEG and Evoked Potentials)

1. Performance

Performance was recorded during the visual continuous performance task (VCPT). The measures can be interpreted regarding impulsivity (commission errors), attention (omission errors, missed trials), reaction times (msec) and variability of reaction times.

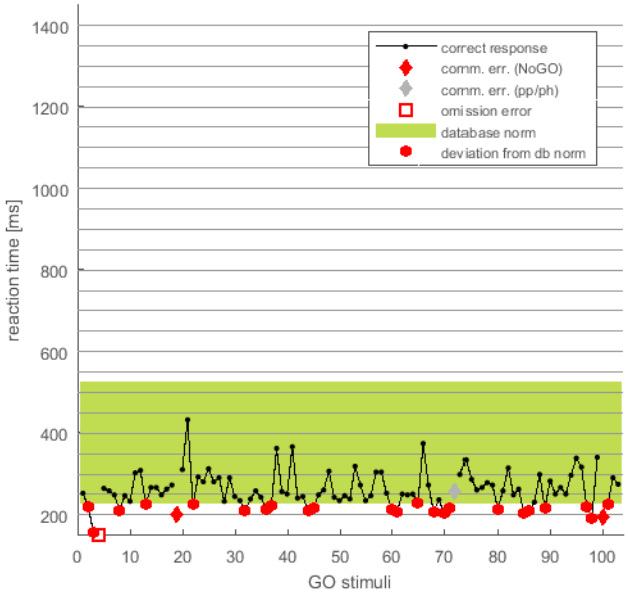
VCPT:

Group name	Correct	Omission	Commission	RT	VR(RT)
a-a GO	99.0 %	1 (1.267)	0	261 (0.193)	4.4 (0.190)
a-p NoGO	98.0 %	0	2 (0.308)	-	-

Number of processed trials: **398** (a-a GO: **100**, a-p NoGO: **100**, p-p: **99**, p-h: **99**)

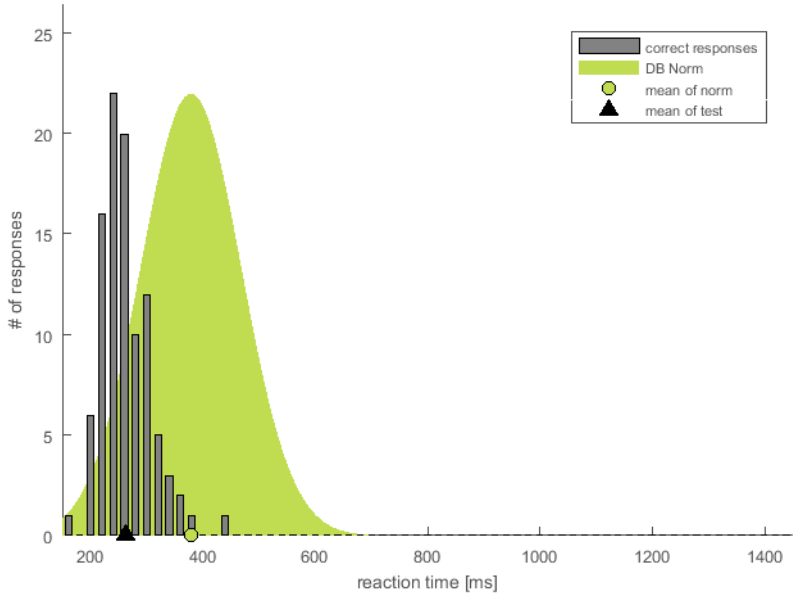
The values of Ano Nymous are within the norm with respect to Attention, Impulsivity, Reaction time and Response consistency.

Figure 1: below, reaction times are presented over time. Red dots represent reaction times below or above database (DB) norm levels. Black dots represent correct responses, red squares omission errors (inattentiveness) and red crosses commission errors (impulsivity).



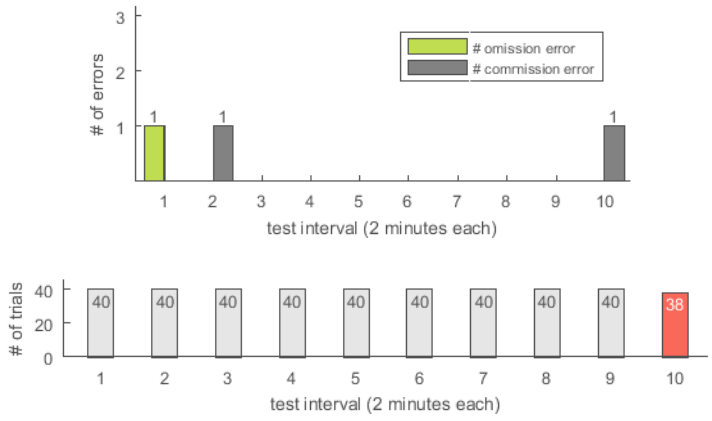
The analysis of Ano Nymous's reaction times compared to peers (green area) show a good consistency in reaction time.

Figure 2: below, reaction times are represented as a function of occurrence. The distribution of grey bars indicates how stable the reaction times were (variability of reaction times). Wide distributions show unstable performance, while narrow distributions can be interpreted as stable performance. The green area indicates the database norm.



The average reaction time of Ano Nymous (black triangle) is similar to his peers (green dot).

Figure 3: below, the distribution of errors over time (intervals of 2 min) is illustrated. More errors towards the end of the task indicate growing fatigue in the course of performance.

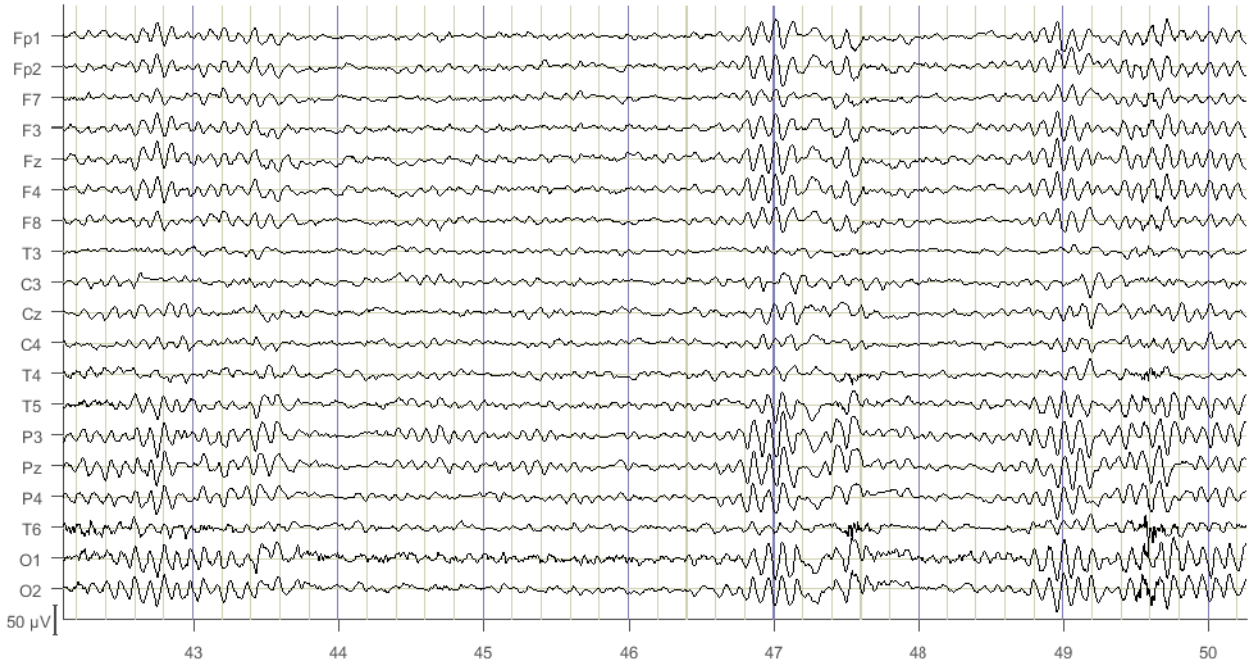


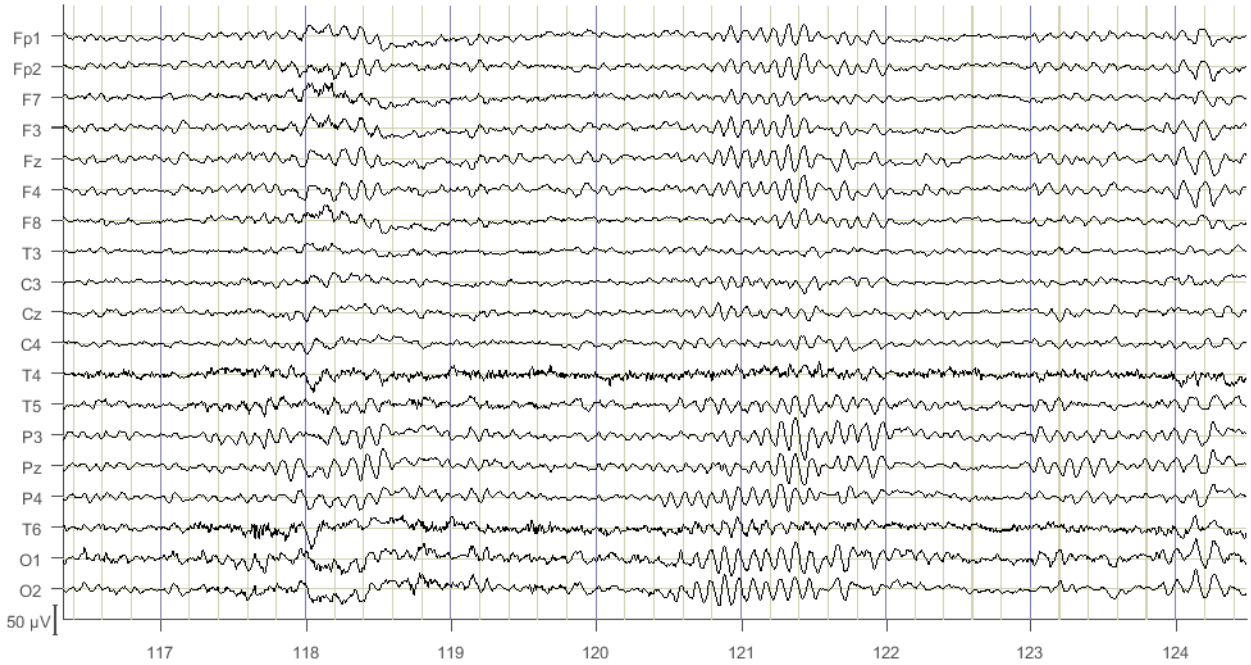
There are only few errors throughout the entire test.

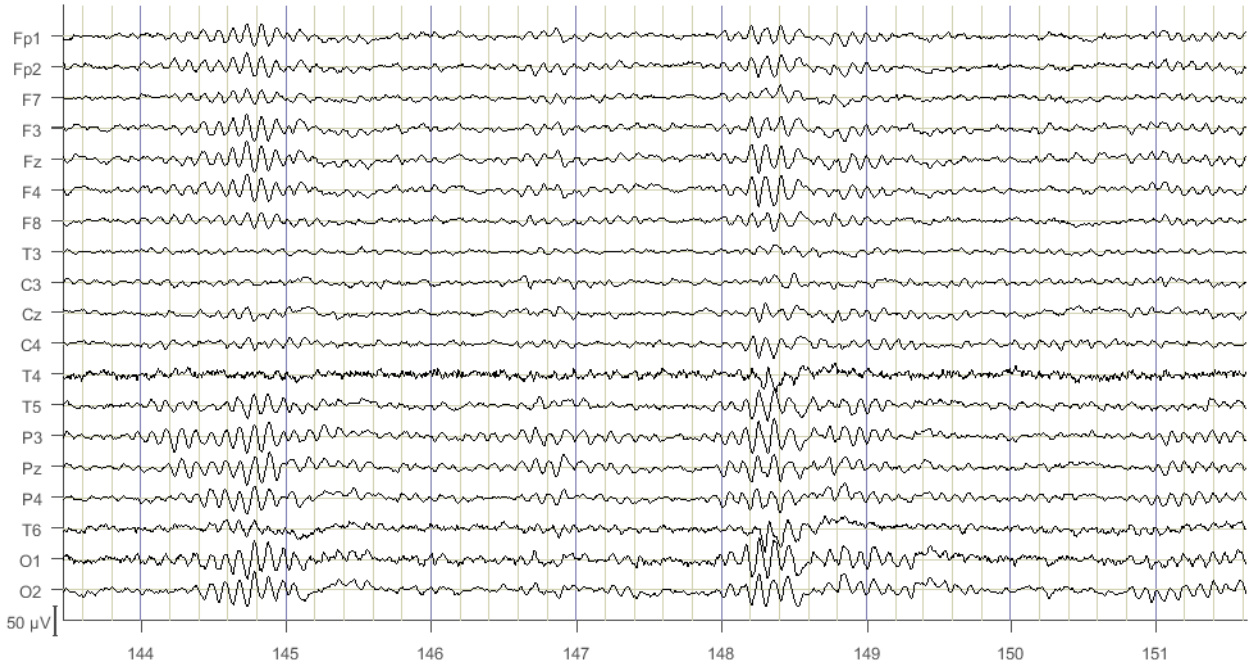
2. Spontaneous EEG

EEG was recorded during relaxation with closed eyes (5 minutes) and opened eyes (5 minutes). From this recording, spectral data was calculated and compared with database population. Database comparison was calculated with weighted montage.

Fragment:




Fp1
Fp2
F7
F3
Fz
F4
F8
T3
C3
Cz
C4
T4
T5
P3
Pz
P4
T6
O1
O2
50 µV
117
118
119
120
121
122
123
124


Fp1
Fp2
F7
F3
Fz
F4
F8
T3
C3
Cz
C4
T4
T5
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Pz
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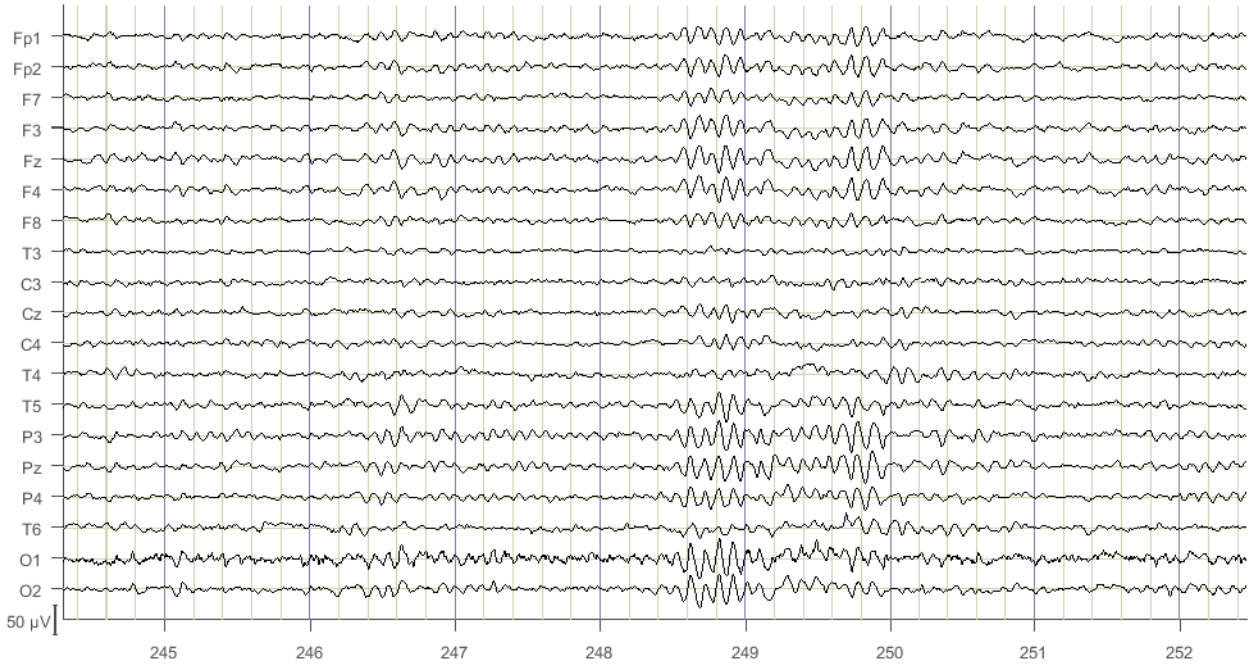
O1
O2
50 µV
144
145
146
147
148
149
150
151


Fp1
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T3
C3
Cz
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O1
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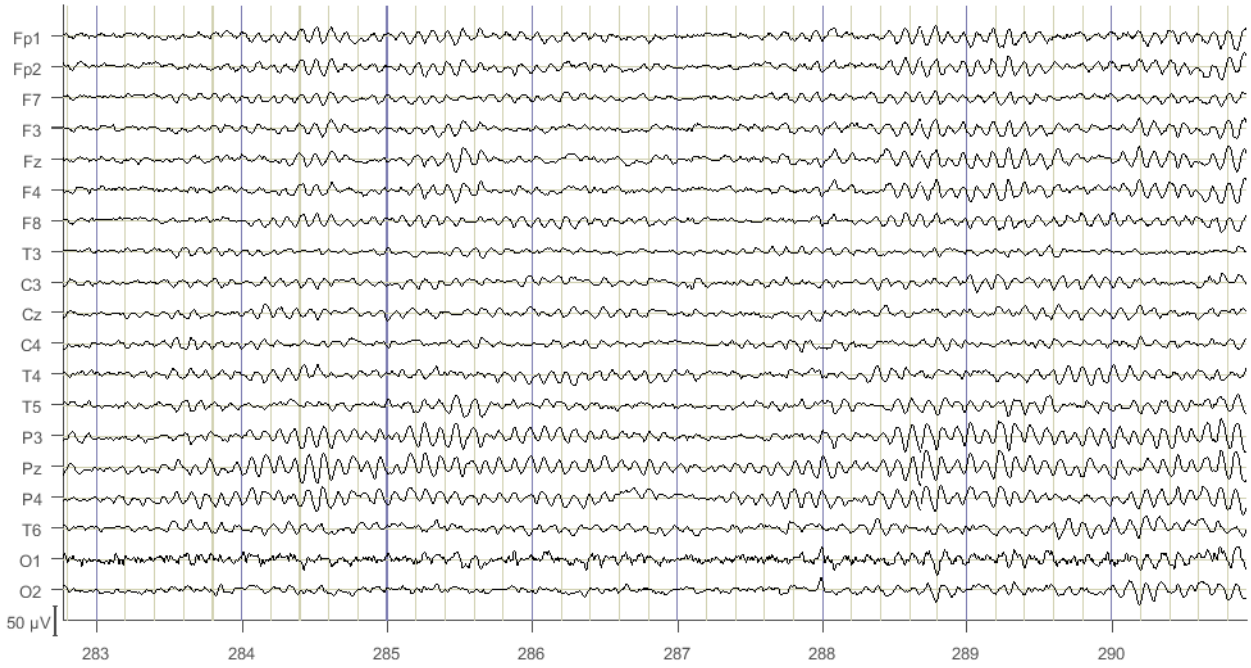
252


Fp1
Fp2
F7
F3
Fz
F4
F8
T3
C3
Cz
C4
T4
T5
P3
Pz
P4
T6
O1
O2
50 µV
283
284
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287
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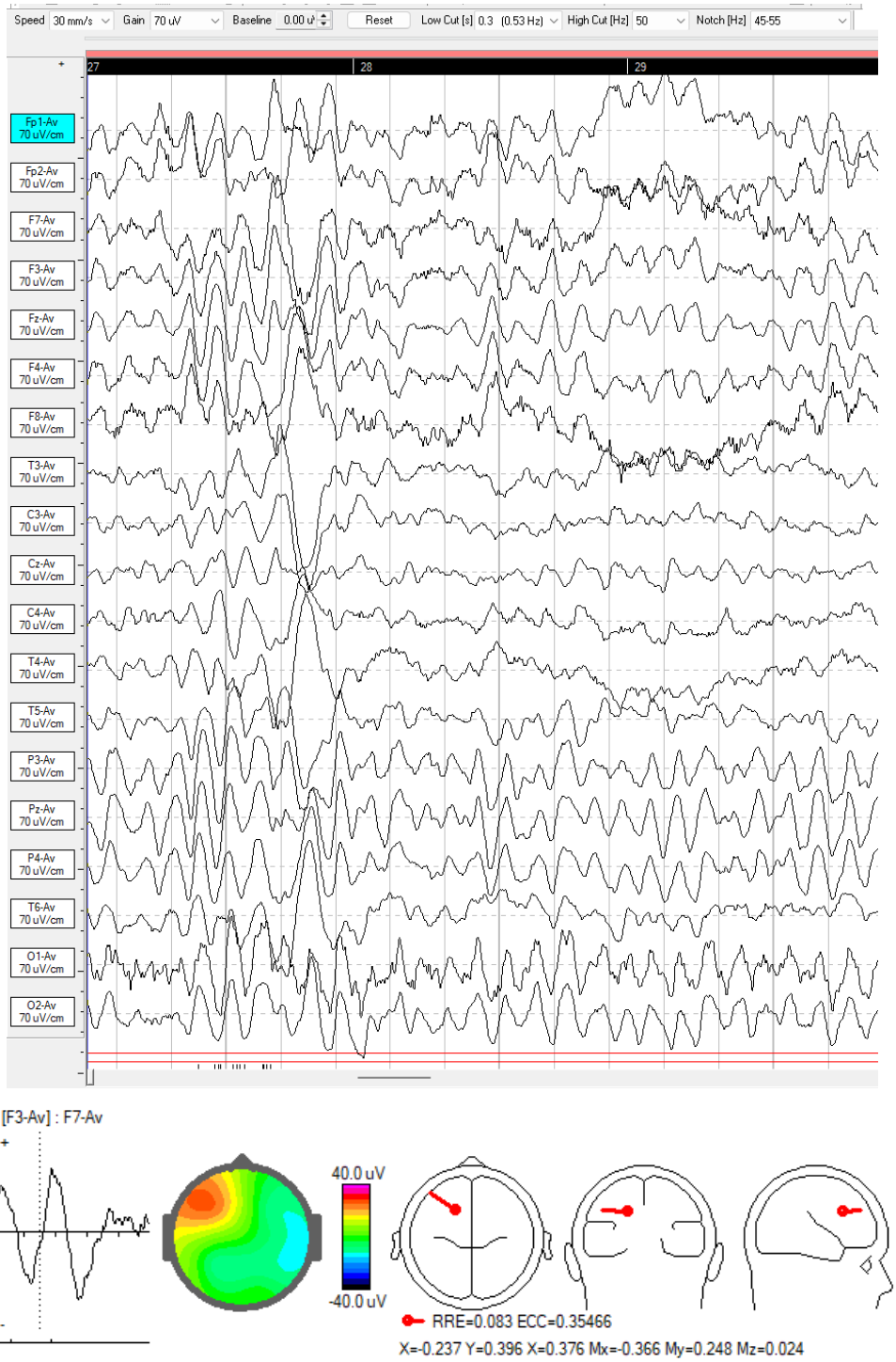
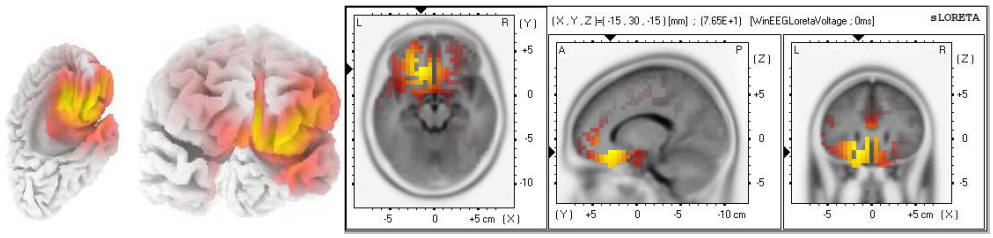
290

3. Visual EEG Analysis

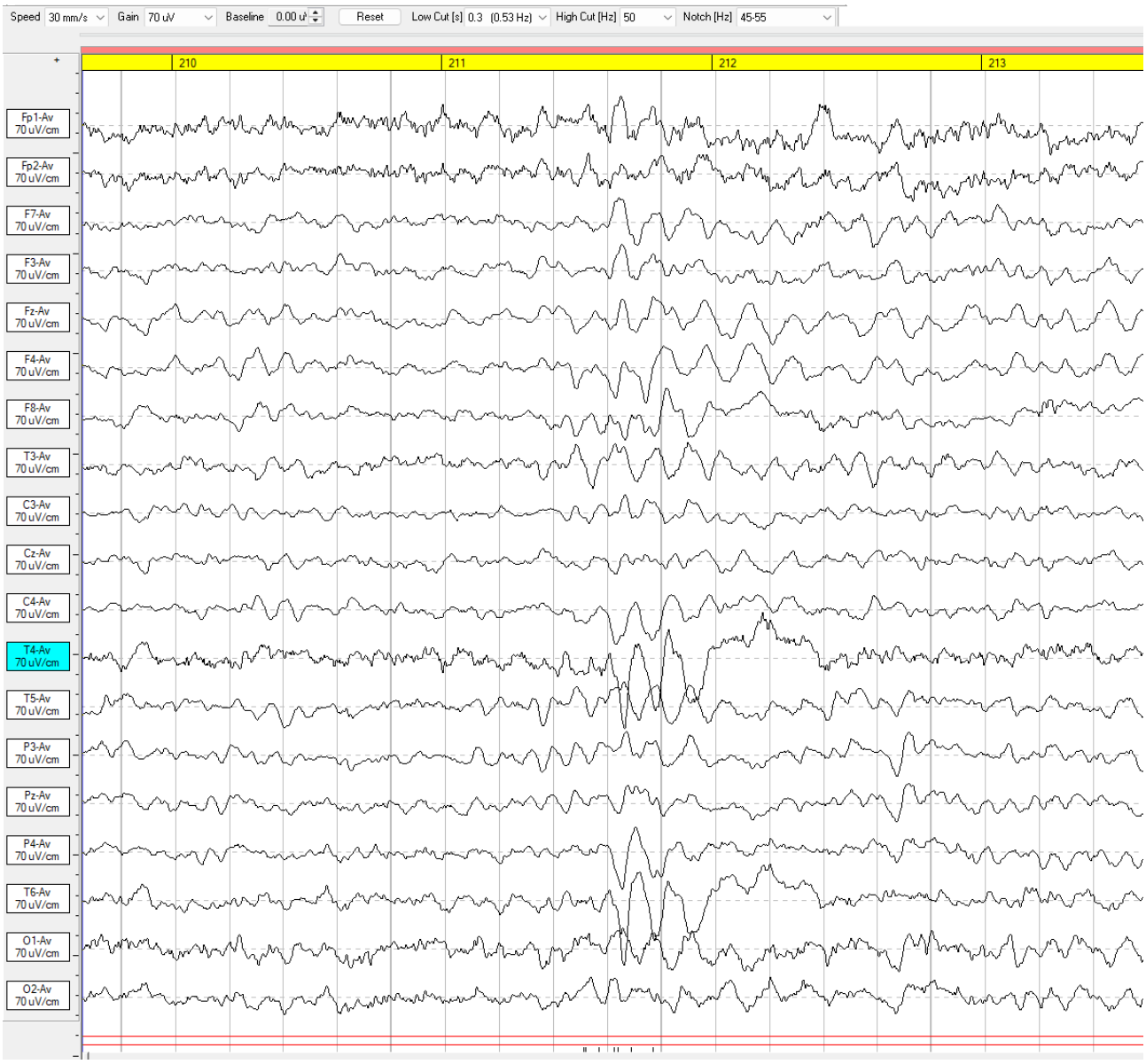


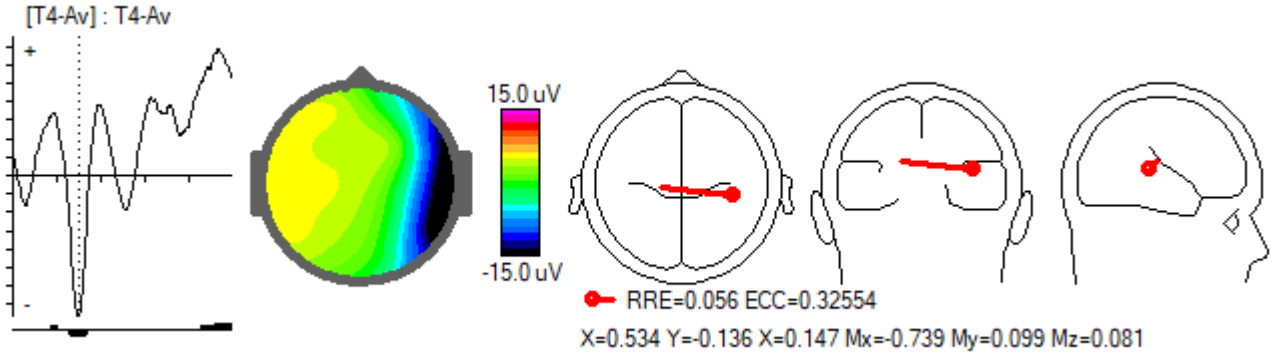


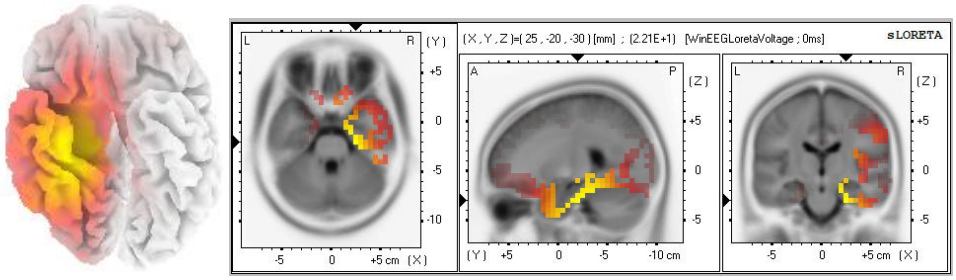
(X= -15 , Y= 30 , Z= -15) (MNI coords) Best Match at 0 mm

Brodmann area 47 Inferior Frontal Gyrus Frontal Lobe:

- mental processes of generating deductions
- the right-side - spatial proximity
- the right-side involved in hypothesis generation
- the left side – category
- enables that new information enters working memory and is then held and manipulated
- plays an important role in social behavior
- predict and assess consequences of actions
- helps to guide behaviour in a social context and in expressing emotions appropriately.


Speed 30 mm/s
Gain 70 uV
Baseline 0.00 uV
Reset
Low Cut [s] 0.3 (0.53 Hz)
High Cut [Hz] 50
Notch [Hz] 45-55
210
211
212
213
Fp1-Av 70 uV/cm
Fp2-Av 70 uV/cm
F7-Av 70 uV/cm
F3-Av 70 uV/cm
Fz-Av 70 uV/cm
F4-Av 70 uV/cm
F8-Av 70 uV/cm
T3-Av 70 uV/cm
C3-Av 70 uV/cm
Cz-Av 70 uV/cm
C4-Av 70 uV/cm
T4-Av 70 uV/cm
T5-Av 70 uV/cm
P3-Av 70 uV/cm
Pz-Av 70 uV/cm
P4-Av 70 uV/cm
T6-Av 70 uV/cm
O1-Av 70 uV/cm
O2-Av 70 uV/cm





(X= 25 , Y= -20 , Z= -30) (MNI coords) Best Match at 0 mm

Brodmann area 36 Parahippocampal Gyrus Limbic Lobe:

- The hippocampus participates in a wide variety of
- memory processes: working memory, semantic memory, episodic memory, and memory retrieval
- active in emotional conditions (e.g., disgust, unpleasant/fearful stimuli, facial emotional perception, etc.)
- related with “novelty discrimination”
- related with “detection of deviant stimuli”
- determines whether the current information is new (and should be stored in memory), or it is old (and no storage is necessary)
- “anticipatory” function, “anticipating regret”, “relational processing during elaboration of future events”, “future event construction.”

4. Visual EEG Analysis

Background Rhythm and Alpha Activity

The occipital dominant rhythm is **9.8 Hz bilaterally (O1/O2)** with an **IAPF of 9.8 Hz**

Preserved symmetry, and normal reactivity to eye opening and closing. This reflects **intact cortical integrity, normal vigilance regulation, and preserved thalamo-cortical function**.

The alpha frequency lies in the low–mid range and is not pathologically slowed, though slightly below the optimal range typically associated with maximal cognitive activation.

Abnormal Alpha Distribution

An **abnormal increase of alpha activity in frontal regions** is present. Frontal alpha dominance reflects **functional inhibition or under-recruitment of frontal executive networks**, rather than activation. This suggests reduced executive drive, diminished top-down control, and difficulty sustaining internally driven, goal-directed cognition. This functional pattern is commonly associated with **attention dysregulation, anxiety-related inhibition, cognitive fatigue, motivational flattening, and limbic–prefrontal imbalance** and does not indicate structural pathology.

Focal Theta–Delta Activity

Intermittent focal theta–delta discharges are observed bilaterally in the **fronto-temporal regions** during eyes-closed recording, with maximal amplitudes over **F7/T3/T5 (left)** and **F8/T4/T6 (right)** and opposite polarity across hemispheres, supporting true focal generators. This pattern indicates **state-dependent fronto-temporal and limbic dysregulation**, often associated with stress-related neural instability, emotional memory load, trauma-related processing, or chronic hyperarousal followed by compensatory inhibition, rather than generalized cortical slowing.

Sharp Alpha–Delta Complexes

In the **right temporal regions (T4–T6)**, **sharp-pointed alpha waves followed by delta activity** are present. This morphology suggests brief emotional or sensory overactivation followed by rapid inhibitory disengagement, reflecting heightened affective sensitivity with limited emotional–cognitive integration.

Functionally, this may manifest as rapid overwhelm, emotional confusion, or transient withdrawal responses.

Integrated Interpretation

Overall, the EEG demonstrates **preserved global brain function** with **functional dysregulation of frontal executive and fronto-temporal emotional networks**. The dominant pattern reflects oscillation between **heightened sensitivity and inhibitory downregulation**, indicating high internal load with limited frontal modulation. No evidence of epileptiform activity, diffuse encephalopathy, or neurodegenerative pathology is present.

Possible Cognitive–Emotional Correlates

This profile is commonly associated with fluctuating attention, increased emotional reactivity, mental fatigue, reduced sustained goal-directed effort, stress sensitivity, and occasional shutdown or dissociative responses under load.

The combined involvement of BA 47 and BA 36 indicates **dysregulated frontal–limbic interaction**, characterized by insufficient frontal modulation of limbic processing. Functionally, this manifests as heightened emotional sensitivity, reduced executive containment, fluctuating attention, and vulnerability to stress-related cognitive–emotional overload, without evidence of structural or epileptiform pathology.

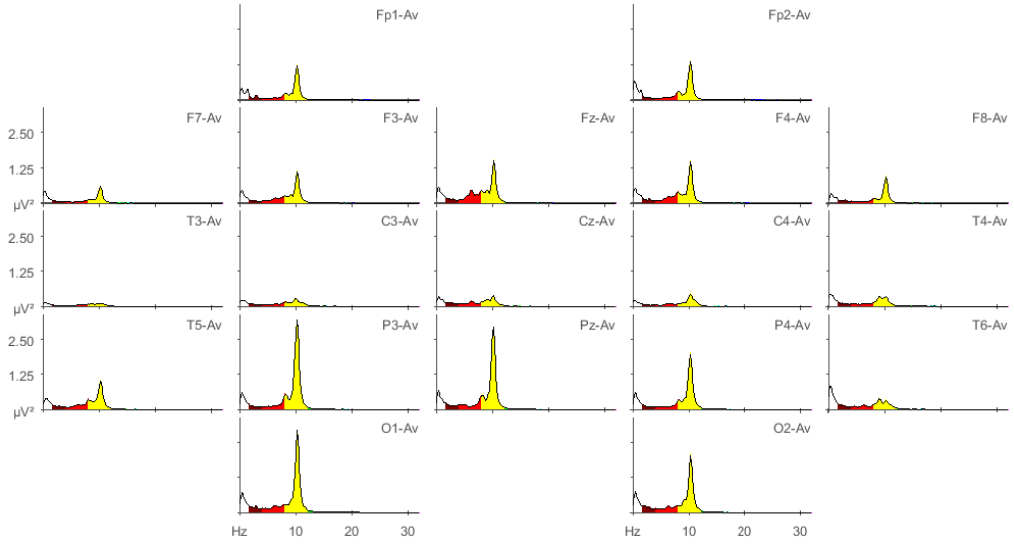
5. Spike Detection

Spikes are sharp transient waves representing interictal epileptiform activity in the brain. The spike detection procedure uses morphological filtering of EEG signals in order to detect such transient activity and separate it from normal background waves.

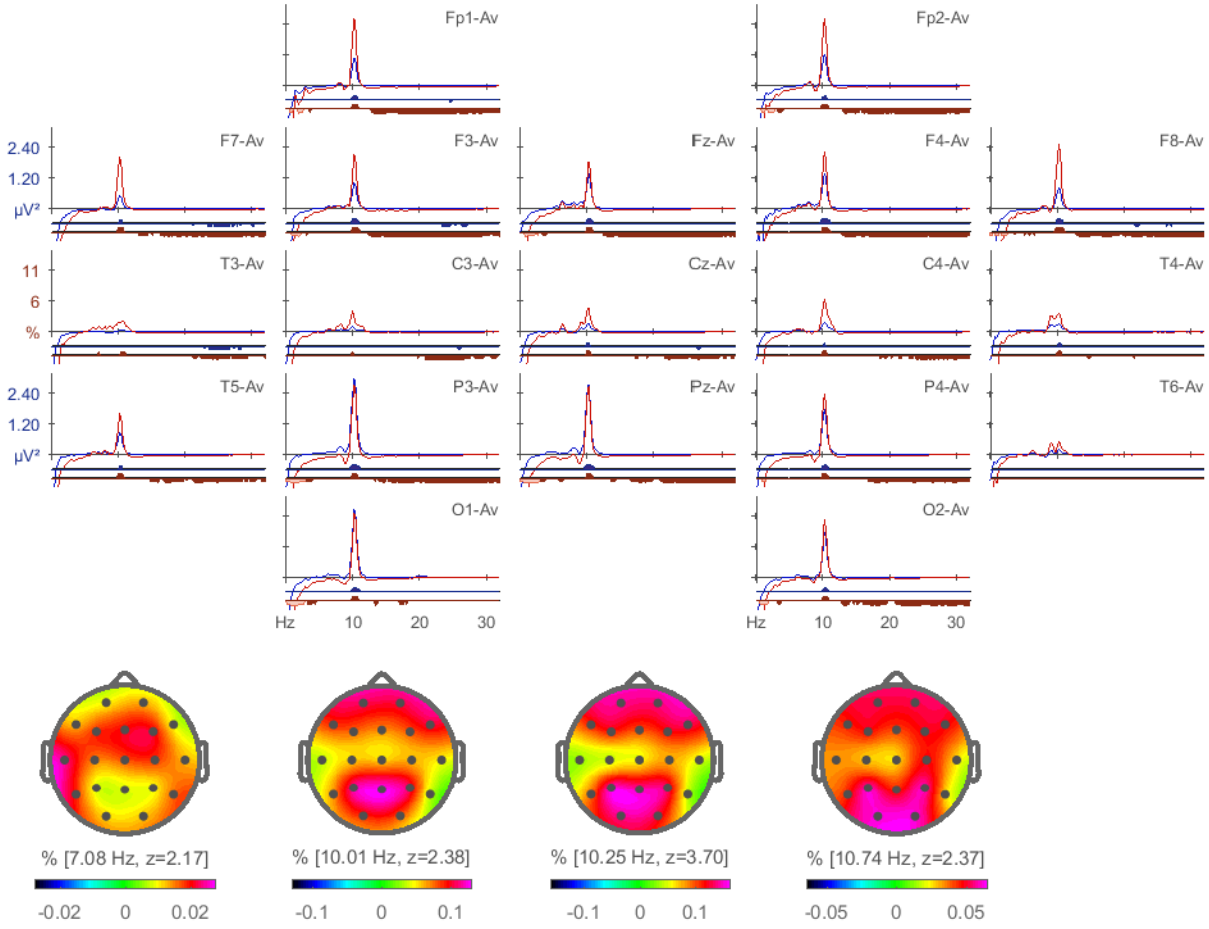
Eyes Closed
No significant events were detected.

Eyes Opened
No significant events were detected.

Spectral data: eyes opened (4:39)

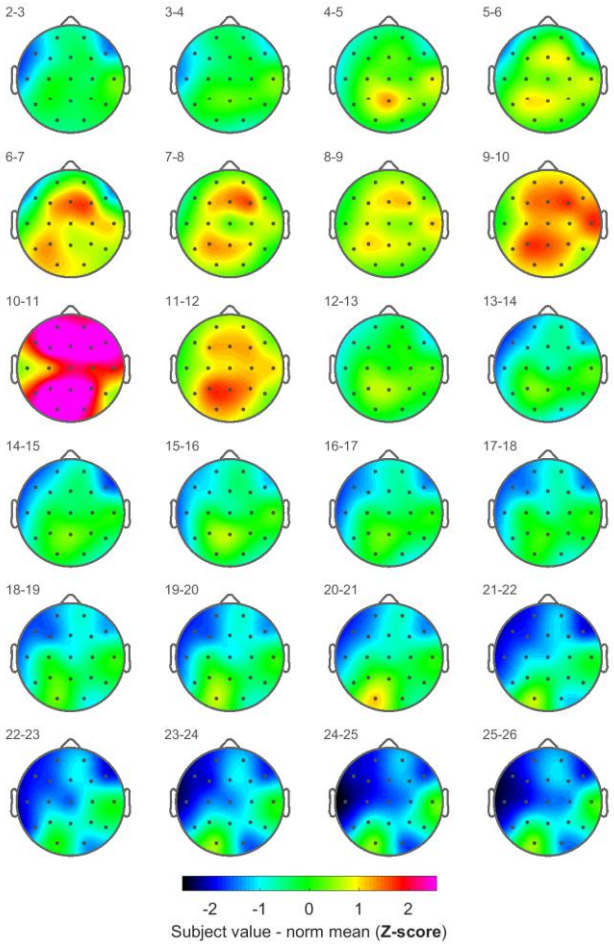


comparison with reference data: Difference (blue: absolute, red: relative). Bars on the bottom line indicate significant deviations from norm.

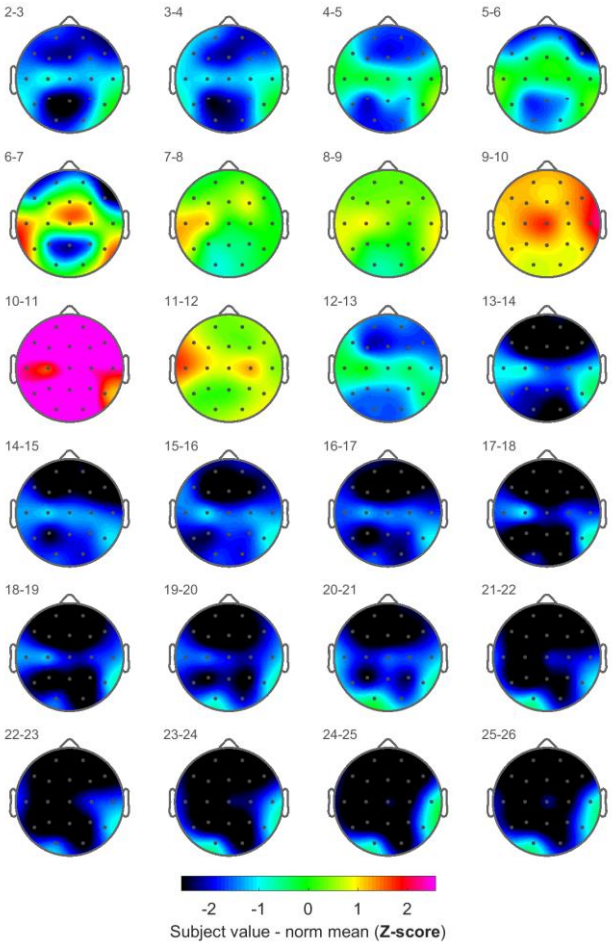


Increased relative theta power frequency in the right temporal area T3
Increased relative alpha power spectra in the prefrontal Fp1, Fp2, frontal F7, F3, Fz, F4, F8, temporal T3, T4, T5, central C3, Cz, C4, parietal P3, Pz, P4, occipital O1, O2 areas

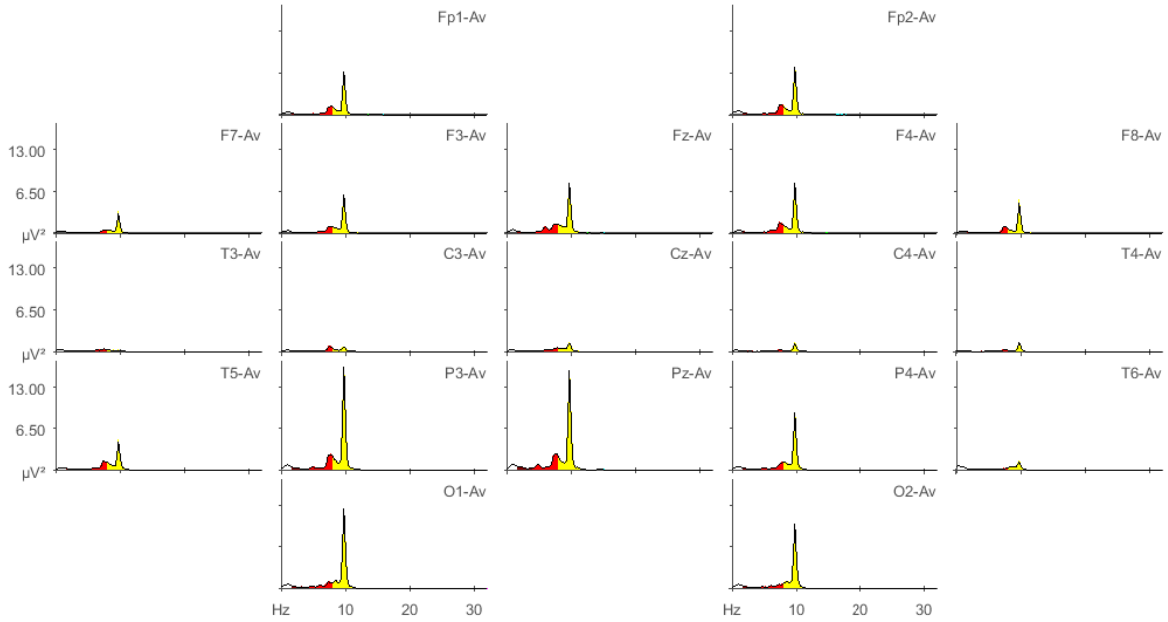
Database - Subject (absolute):



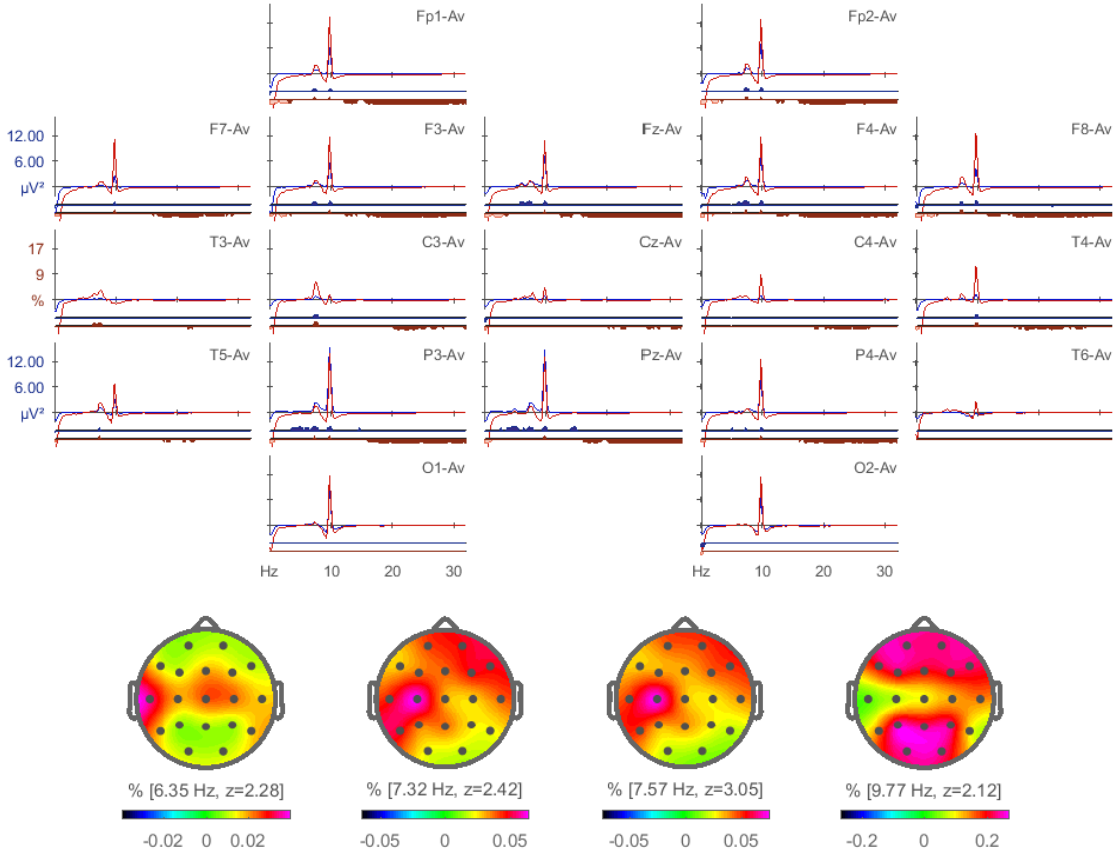
Database - Subject (relative):



Spectral data: eyes closed (4:47)

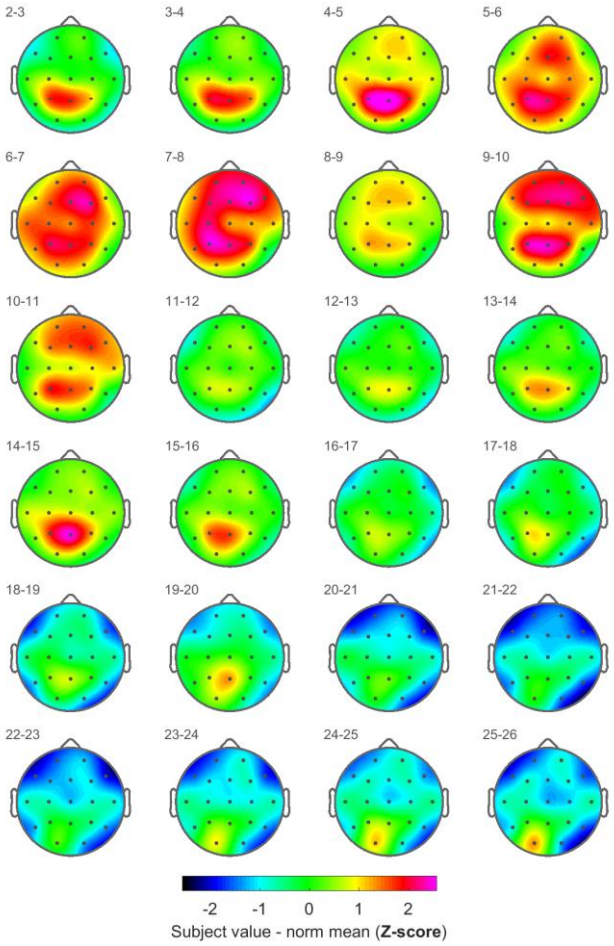


comparison with reference data: Difference (blue: absolute, red:relative). Bars on the bottom line indicate significant deviations from norm.

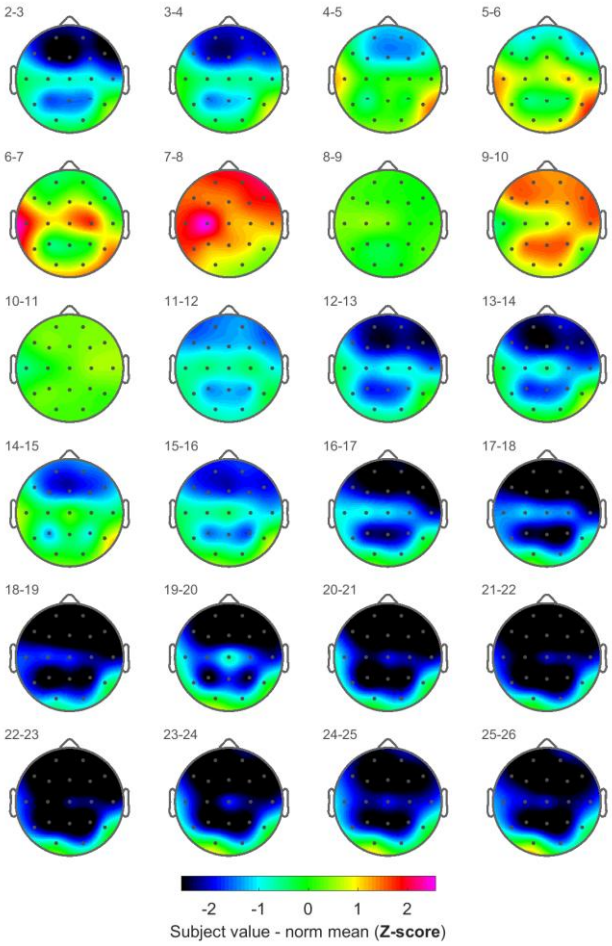


Increased relative theta power frequency in the prefrontal Fp1, Fp2, frontal F4, F8, temporal area T3, T5, central C3, parietal P3 areas
Increased relative alpha power spectra in the prefrontal Fp1, Fp2, frontal F7, F3, Fz, F4, F8, temporal T4, parietal P3, Pz, P4 areas

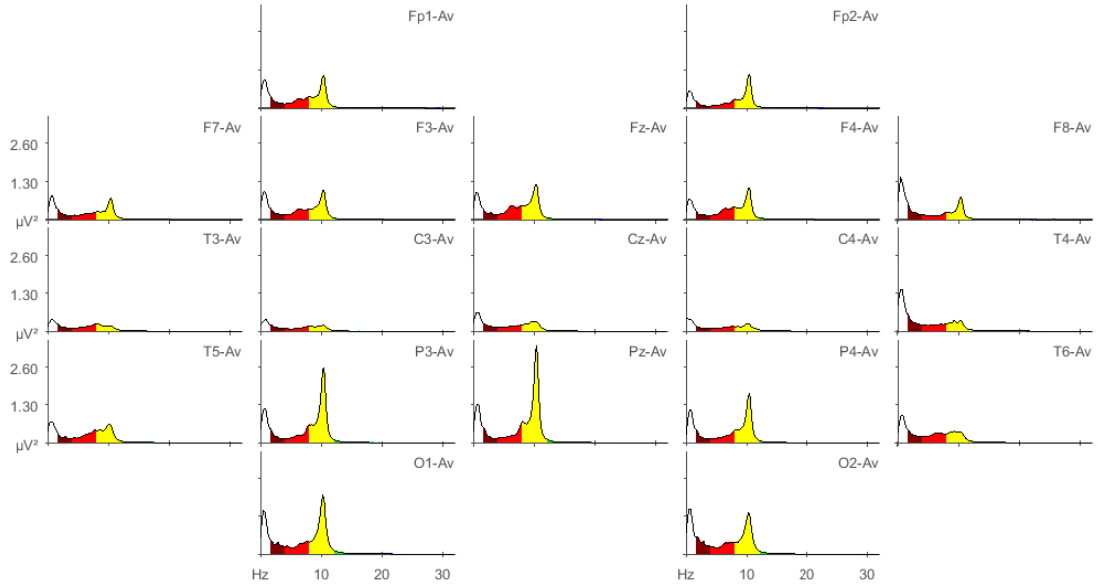
Database - Subject (absolute):



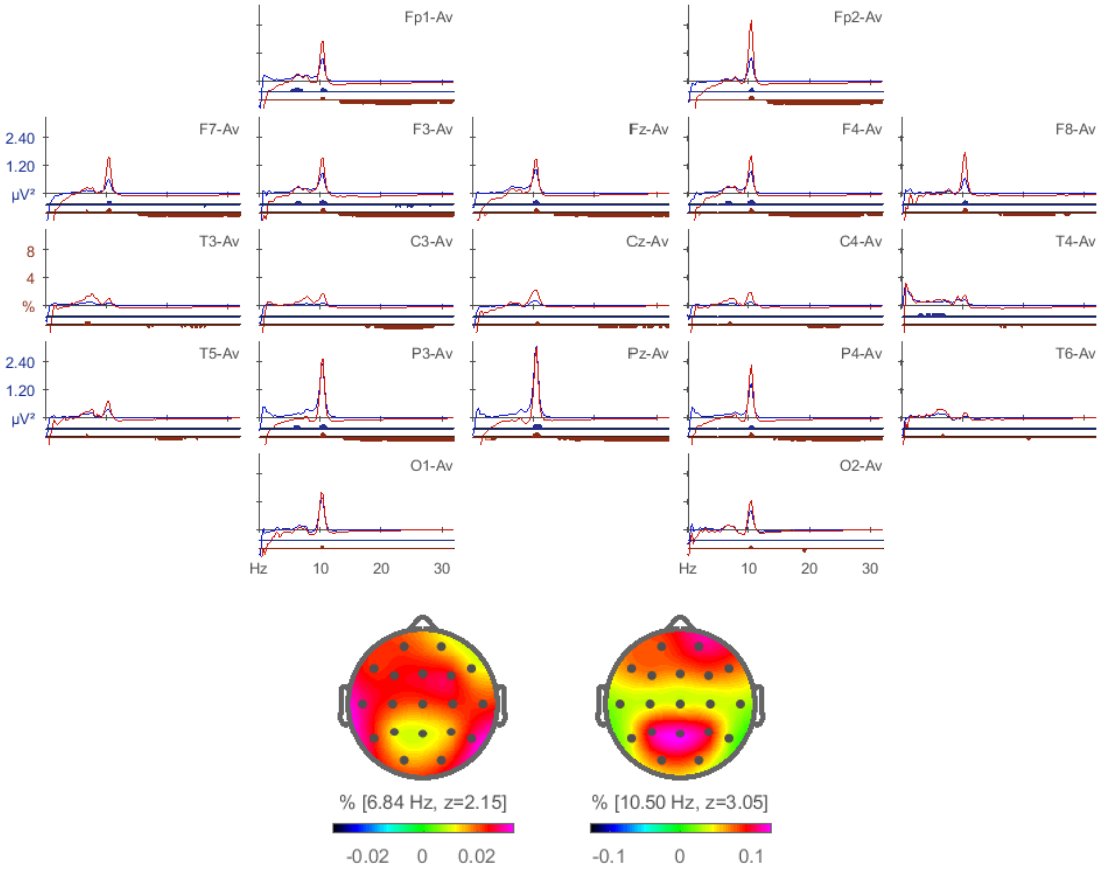
Database - Subject (relative):



Spectral data: VCPT (20:44)

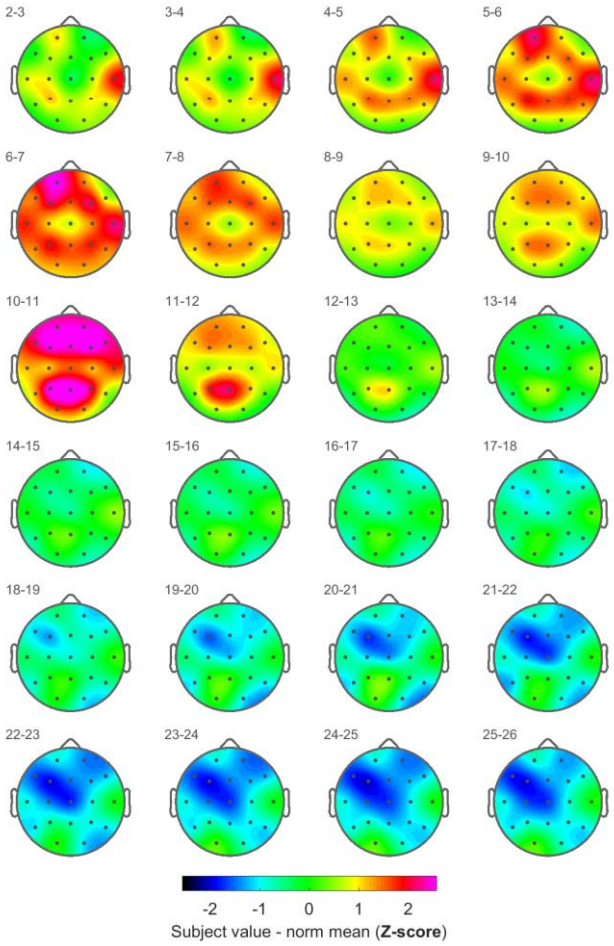


comparison with reference data: Difference (blue: absolute, red: relative). Bars on the bottom line indicate significant deviations from norm.

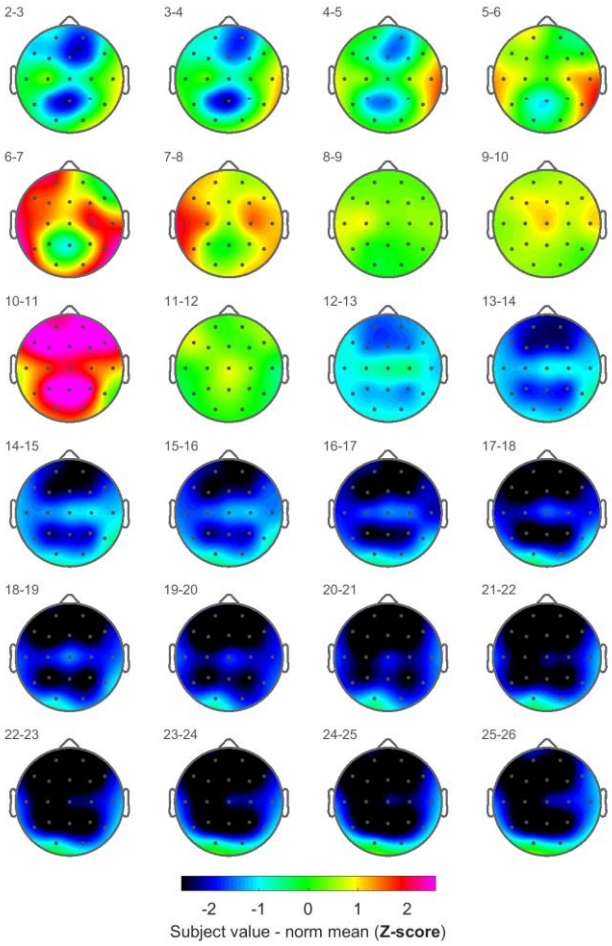


Increased relative theta power frequency in the frontal F7, temporal area T3, T4, T5, T6, central C4 areas
Increased relative alpha power spectra in the prefrontal Fp1, Fp2, frontal F7, F3, Fz, F4, F8, parietal P3, Pz, P4, occipital O1, O2 areas

Database - Subject (absolute):



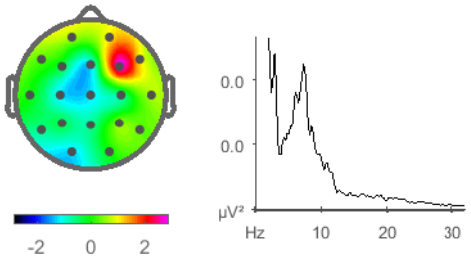
Database - Subject (relative):



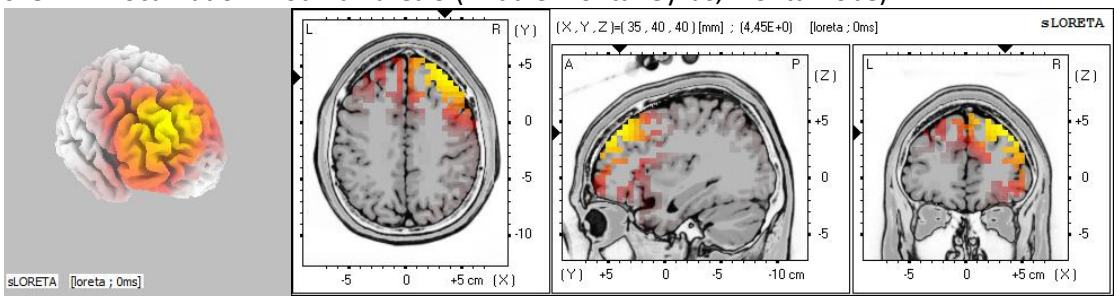
SLORETA

The graphs represent an approximation of the source generator in the cortex calculated through mathematical procedures. Hence the calculated localization can differ from the real source. Therefore, expert knowledge based on functional neuronal models should ultimately determine the clinical relevance of these findings.

Following deviations were calculated (EO):
1. frequency: 7.08 Hz
Graph of the independent component of this activity:

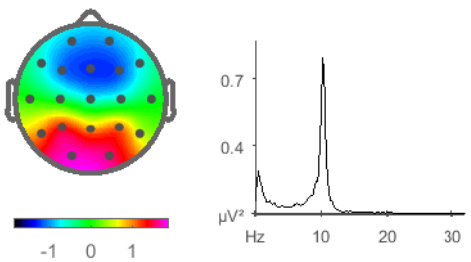


sLORETA localization Brodman area 9 (Middle Frontal Gyrus, Frontal Lobe)

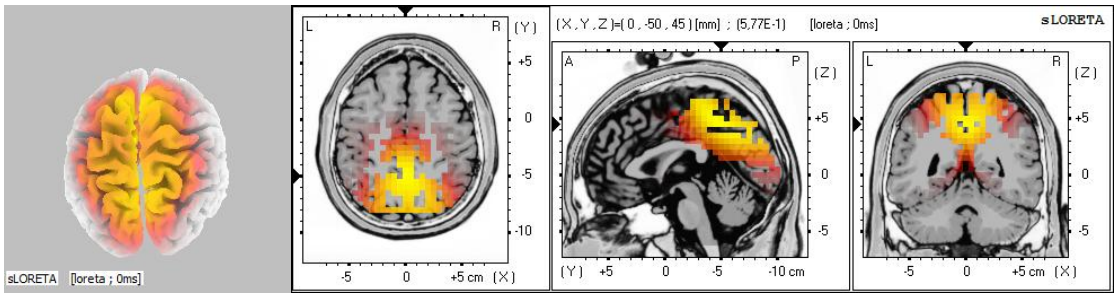


Brodmann area 9: BA 9 and BA 46 constitute the dorsolateral prefrontal cortex (DLPfC). BA 9 is involved in working memory and is responsable for goal-oriented planning of behaviour. This area is in charge of monitoring that given rules are followed during the entire process. The verbal working memory (phonological loop, repetitive recall) is located principally in the left hemisphere, whereas the visuo-spatial WM is represented in the right hemisphere. Working Memory: active holding and manipulation of information. Dopaminergic fibers from the tegmental ventral area reach an end at the DLPfC contributing to enhanced motivation by succesful learning.

2. frequency: 10.01 Hz
Graph of the independent component of this activity:

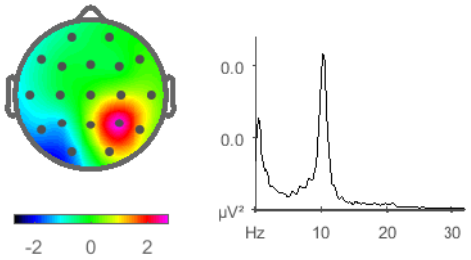


sLORETA localization Brodman area 31 (Precuneus, Frontal Lobe)

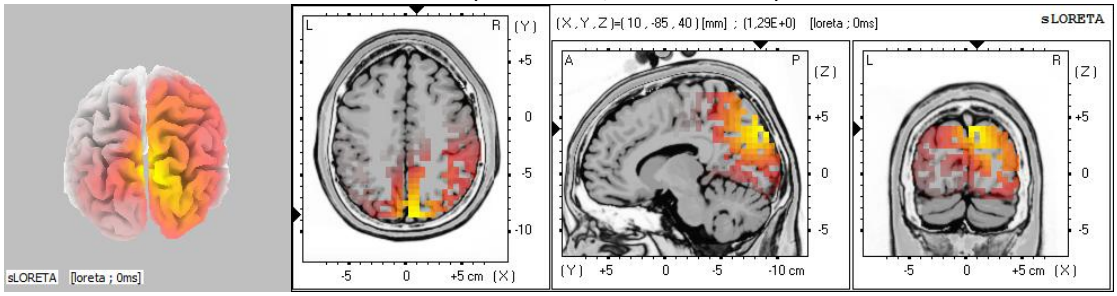


Brodmann area 31: Limbic cortex. This area is located in the region of the precuneus. Together with BA 23 it constitutes the posterior cingulate gyrus (PCC), whereas BA 31 represents the posterior part of it. The PCC is principally involved in sensory information assessment and memory performance, by processing visual-spatial information, eye movements and imagined representations. Lesions to the posterior cingulate gyrus affect learning and memory (long term memory).

3. frequency: 10.01 Hz
Graph of the independent component of this activity:

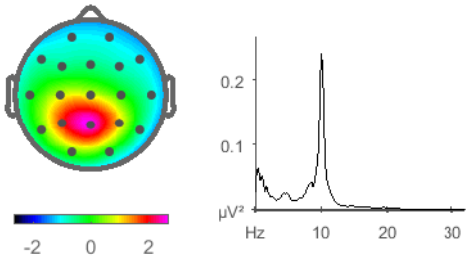


sLORETA localization Brodman area 19 (Precuneus, Parietal Lobe)

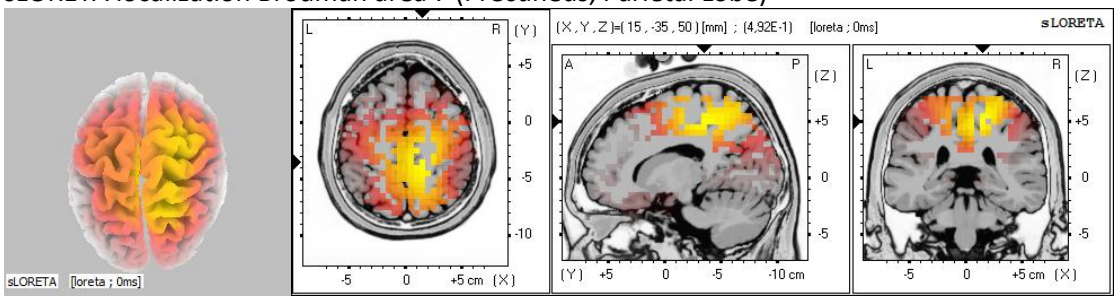


Brodmann area 19: Is located in the occipital lobe and represents the visual association cortex also known as extrastriate cortex. BA 19 can be further divided into V3, V4 and V5: V3 receives afferences from BA 18, this area determines movement information of gross shapes and helps recognizing familiar figures. V4 is involved in visual direction of attention. V4 processes color; through white balance it enables color recognition (color constistency) irrespective of hue, that arises from wave length shifts under different light conditions. V5 corresponds to the Movement territory; this area responds to movement and movement direction together with MST (medial superior temporal area = V5a).

4. frequency: 10.25 Hz
Graph of the independent component of this activity:

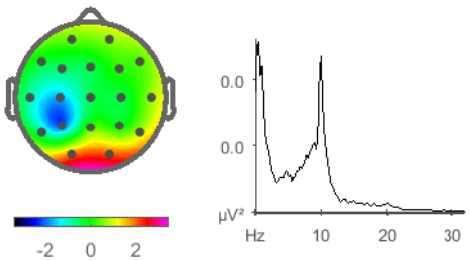


sLORETA localization Brodman area 7 (Precuneus, Parietal Lobe)

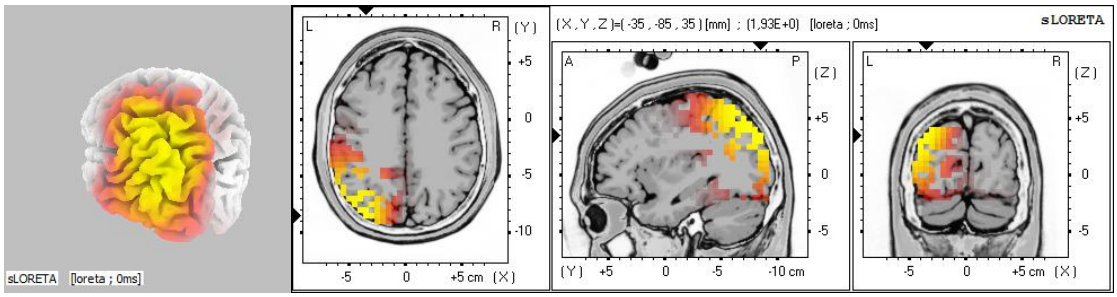


Brodmann area 7: Precuneus The Precuneus represents the end of the cingulum and has the following functions:
Awareness: the precuneus is essential for conscious information processing.
Default-mode network: The default network is responsible for the awake resting state of the brain; the ventral precuneus is part of this network, meaning that self-awareness and self-perception are important components of the default network.
Parietal-prefrontal-central network: The precuneus is part of the fronto-parietal network, which is in charge of activating many cognitive and emotional functions.
Visual and sensory association area functions. Speech comprehension in the dominant hemisphere. This association cortex integrates somatosensory information with visual, auditory and vestibular information, enabling spatial localization of objects. This spatial perception is the basis for directed eye-, hand- and body movements; it provides sensory information fundamental for complex directed movements.

5. frequency: 10.25 Hz
Graph of the independent component of this activity:

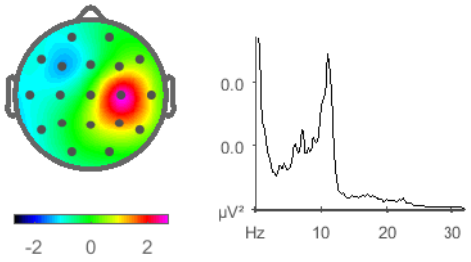


sLORETA localization Brodman area 19 (Precuneus, Parietal Lobe)

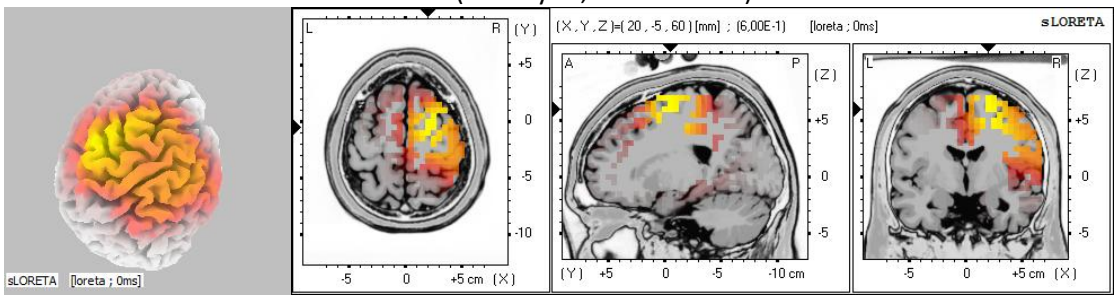


Brodmann area 19: Is located in the occipital lobe and represents the visual association cortex also known as extrastriate cortex. BA 19 can be further divided into V3, V4 and V5: V3 receives afferences from BA 18, this area determines movement information of gross shapes and helps recognizing familiar figures. V4 is involved in visual direction of attention. V4 processes color; through white balance it enables color recognition (color constistency) irrespective of hue, that arises from wave length shifts under different light conditions. V5 corresponds to the Movement territory; this area responds to movement and movement direction together with MST (medial superior temporal area = V5a).

6. frequency: 10.74 Hz
Graph of the independent component of this activity:



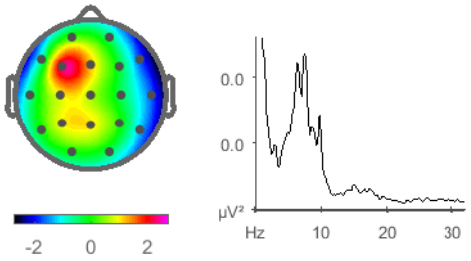
sLORETA localization Brodman area 6 (Sub-Gyral, Frontal Lobe)



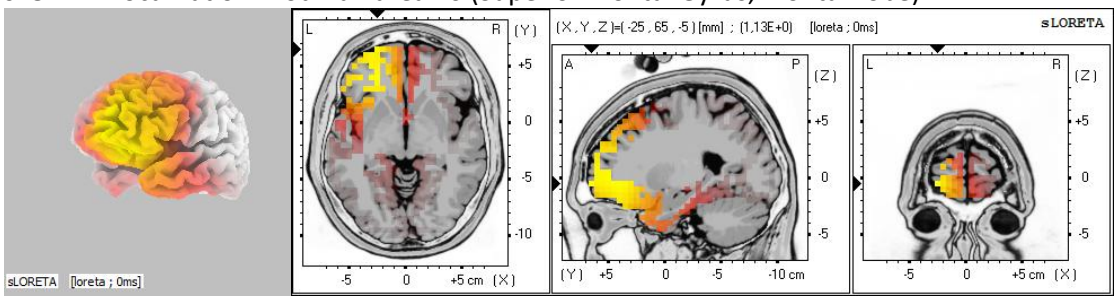
Brodmann area 6: Is located in the frontal cortex and includes the premotor area PMA (lateral of BA 6) and supplementary motor area SMA (medial BA 6). BA 6, BA 4 and BA 24-the cingulate motor cortex, become active together with the basal ganglia and cerebellum when movement is planned, initiated and executed. BA 6 stores action plans and strategies, recalls motor memories and movement sequences, enabling optimization of movement processes. The supplementary motor area SMA is involved in planning and initiation of complex movements, also bimanual coordination. Several studies have found that the lateral BA 6 is also active during mental arithmetic; other studies indicate that BA 6 is the beginning and end of the frontostriatal loop, which is part of the executive system. Additional to motor execution, the frontostriatal loop is also involved in planning, control and regulation of somatosensory, emotional and cognitive impulses.

Following deviations were calculated (EC):

1. frequency: 6.35 Hz
Graph of the independent component of this activity:

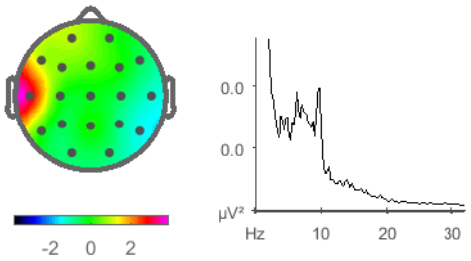


sLORETA localization Brodman area 10 (Superior Frontal Gyrus, Frontal Lobe)

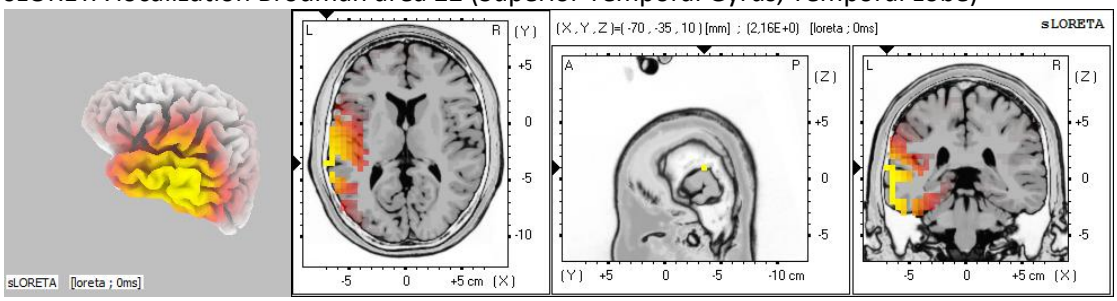


Brodmann area 10: Is part of the anterior (rostral) prefrontal cortex (PfC) and represents the frontal association area. This area is involved in executive functions by participating in task management, planning and monitoring of actions. In this sense, BA 10 is responsible for adjusting the initial plan according to outcomes, considering several things at a time and integrating external stimuli with internal thought processes.

3. frequency: 6.35 Hz
Graph of the independent component of this activity:



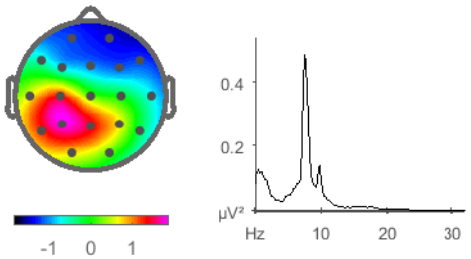
sLORETA localization Brodman area 22 (Superior Temporal Gyrus, Temporal Lobe)



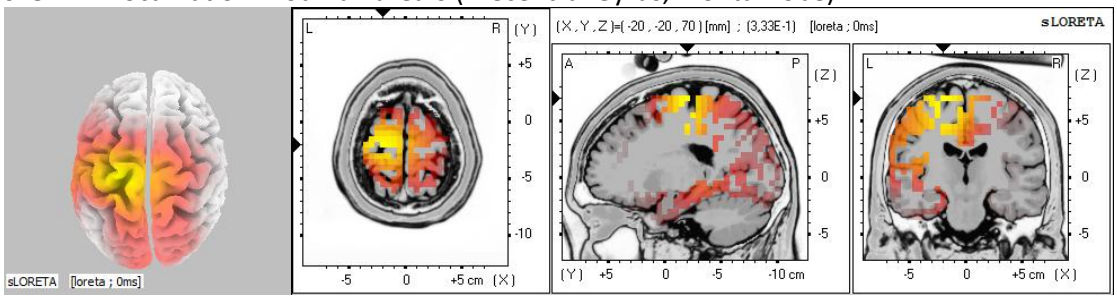
Brodmann area 22: Is located in the temporal lobe and forms, together with BA 42, the secondary auditory cortex (A II). The anterior part represents the auditory association cortex, whereas the posterior part is known

as Wernicke's area. BA 22 enables auditory perceptual consistency. The left side is in charge of speech sound recognition, whereas the right side processes melody, timbre, rhythm and tone of language and music. This lateralized processing applies for most right-handers, 60% of ambidextrous and 70% of left-handers. Wernicke's area together with BA 39 processes speech comprehension, hereby contributing to understanding oral or written language. This is different from nonsense words that only activate the visual cortex, or pure tones that are only represented in the auditory cortex. It is assumed that BA 22 stores meaningful entities (morphemes), whereas BA 42 stores phonemes.

5. frequency: 7.57 Hz
Graph of the independent component of this activity:



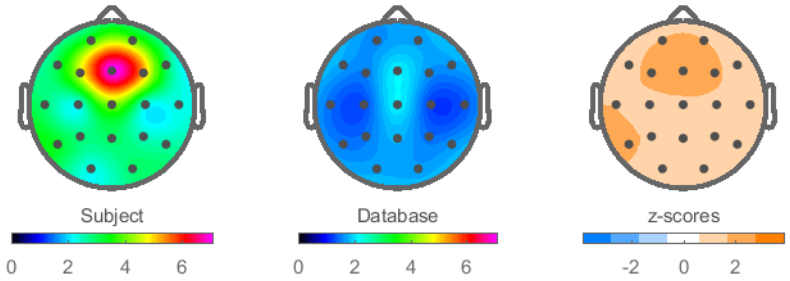
sLORETA localization Brodman area 6 (Precentral Gyrus, Frontal Lobe)



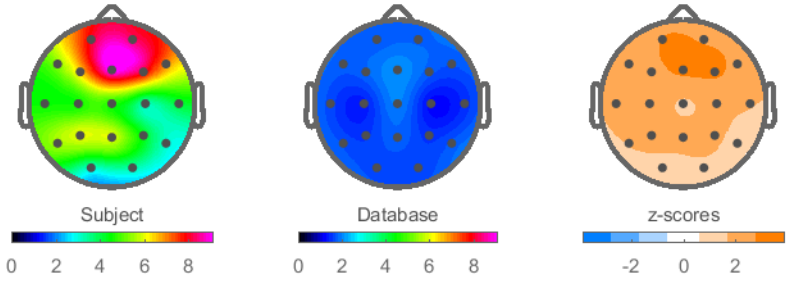
Brodmann area 6: Is located in the frontal cortex and includes the premotor area PMA (lateral of BA 6) and supplementary motor area SMA (medial BA 6). BA 6, BA 4 and BA 24-the cingulate motor cortex, become active together with the basal ganglia and cerebellum when movement is planned, initiated and executed. BA 6 stores action plans and strategies, recalls motor memories and movement sequences, enabling optimization of movement processes. The supplementary motor area SMA is involved in planning and initiation of complex movements, also bimanual coordination. Several studies have found that the lateral BA 6 is also active during mental arithmetic; other studies indicate that BA 6 is the beginning and end of the frontostriatal loop, which is part of the executive system. Additional to motor execution, the frontostriatal loop is also involved in planning, control and regulation of somatosensory, emotional and cognitive impulses.

Theta/Beta-Ratio

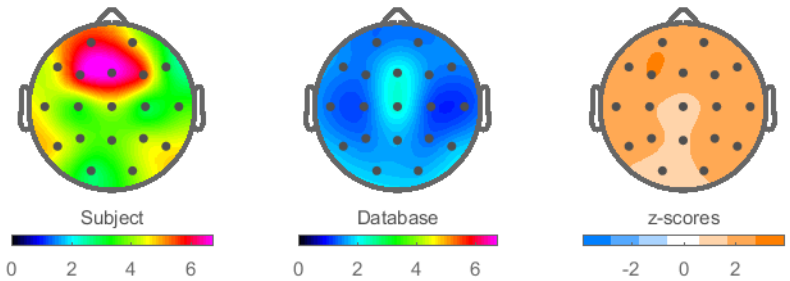
The Theta/Beta ratio gives an index as to the quality of an individual's ability to pay attention. This ratio is negatively correlated with age, as it is expected to be larger in younger children, smaller in adulthood and rises again in later adulthood. This is measured in a GO/NOGO Test where it is expected that a higher ratio will produce more errors. This ratio has been demonstrated in the research of Monastra (Monastra et. al., 1999).



Eyes open



Eyes closed



VCPT

Version	v01	v01	v01

Eyes open	Fz	Cz	Pz
Subject (Stanine)	**7.07** (99.7% | 9)	**4.13** (91% | 8)	**2.97** (86.4% | 7)

Eyes closed	Fz	Cz	Pz
subject (Stanine)	**9.08** (99.9% | 9)	**4.64** (94.3% | 8)	**5.94** (97.7% | 9)

VCPT	Fz	Cz	Pz
Subject (Stanine)	**6.75** (99.1% | 9)	**4.29** (90.5% | 8)	**3.76** (93.9% | 8)

Arousal

This index represents the arousal caused by the vegetative nervous system. It is specifically the parietal and occipital branch projected from the insula to the respective regions. The index is calculated separately for each hemisphere. The patient's index is set in bold, the arousal index of the age group is shown in parentheses. Scientific papers on this index are being prepared. First results show that this index hints at patient's level of apathy, lethargy, unrest, and stress. The higher the value, the higher the inner unrest.

Version	v10	v10
Eyes open	**O1 relative** **Left hemisphere**	**O2 relative** **Right hemisphere**
Subject (stanine)	**-0.69** (0.2% | 1)	**-0.53** (0.1% | 1)
Eyes closed	**O1 relative** **Left hemisphere**	**O2 relative** **Right hemisphere**
Subject (stanine)	**-2.00** (3.1% | 1)	**-1.53** (3.2% | 1)
VCPT	**O1 relative** **Left hemisphere**	**O2 relative** **Right hemisphere**
Subject (stanine)	**0.10** (2.9% | 1)	**1.08** (6.5% | 2)

Arousal in relationship to focusing

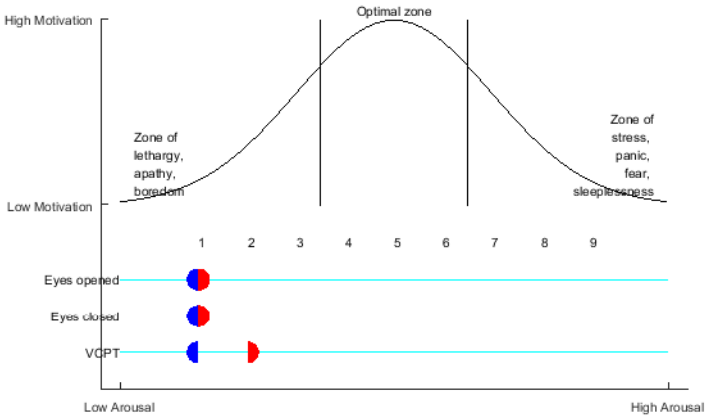
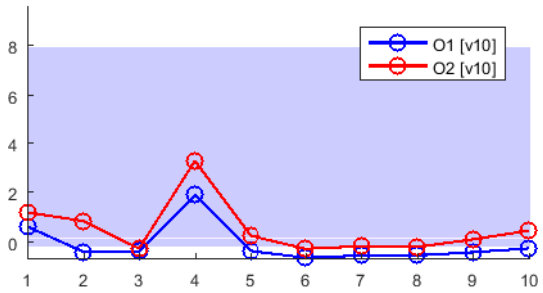


Figure 1: Arousal-Index of the left hemisphere (blue) and the right hemisphere (red) in eyes opened, eyes closed and VCPT.

Compared with peers, Ano Nymous shows in all conditions significantly reduced values. These values indicate a significantly lower activation. This often leads to a lack of motivation and a lowered willingness towards effort. In unsecure situations, Ano Nymous might express fears and misgivings. One observes a depressive mood modulation as well as significant unreal perception of everyday life. Often, a compensation is sought through external stimulation (gaming, other excessive behaviors). This behavior yields a bearable internal level of activation.A reduced activation often leads to loss of focus.

Arousal modulation during VCPT

A VCPT recording lasts around 21 minutes. This data was split into 10 equally long epochs, with each epoch lasting for around 125 seconds. Arousal was measured for each epoch. Left hemisphere (O1) and right hemisphere (O2) were recorded separately.



For Ano Nymous, both hemispheres are synchronized.

6. Central-sensory Index (relative power, beta-gamma squared); CSI

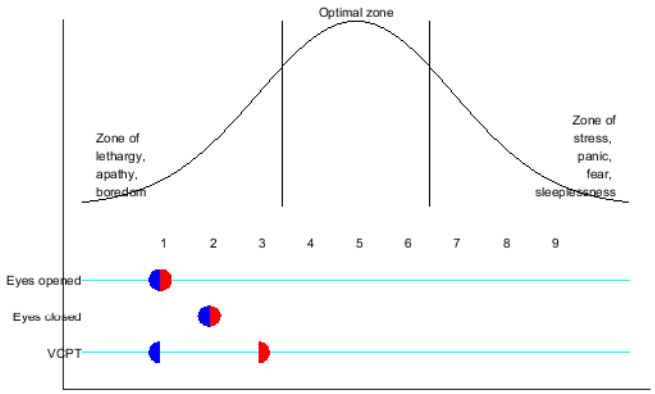
The central sensory index reflects the organization and functioning of the somatosensory areas. They receive information from many different systems: thalamic nuclei, basal ganglia, limbic system and cingulate system. Functionally, the CSI gives clues to the way of processing: low values are associated with increased introspection/introversion, high values with increased external orientation or extraversion. In children, the CSI provides important information regarding processing in a stimulus-intensive context. In adults, essential indications on the dimension anxiety/internal excitement can be obtained. The scientific publication is still pending.

Version	v01	v01

Eyes open	**Left hemisphere**	**Right hemisphere**
Subject (Stanine)	**1.67** (1.3% | 1)	**1.56** (0.8% | 1)

Eyes closed	**Left hemisphere**	**Right hemisphere**
Subject (Stanine)	**1.56** (7% | 2)	**1.63** (7.7% | 2)

During VCPT	**Left hemisphere**	**Right hemisphere**
Subject (Stanine)	**1.82** (3.3% | 1)	**2.04** (12% | 3)

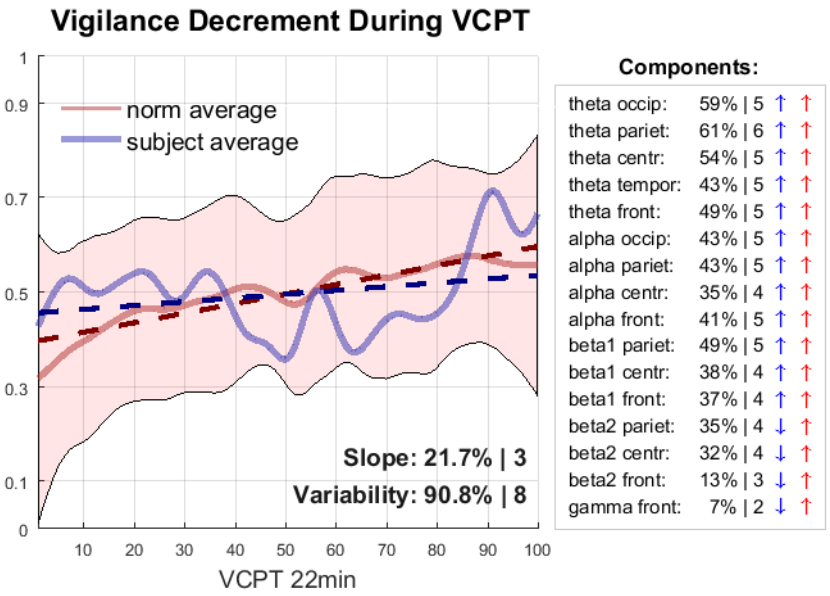


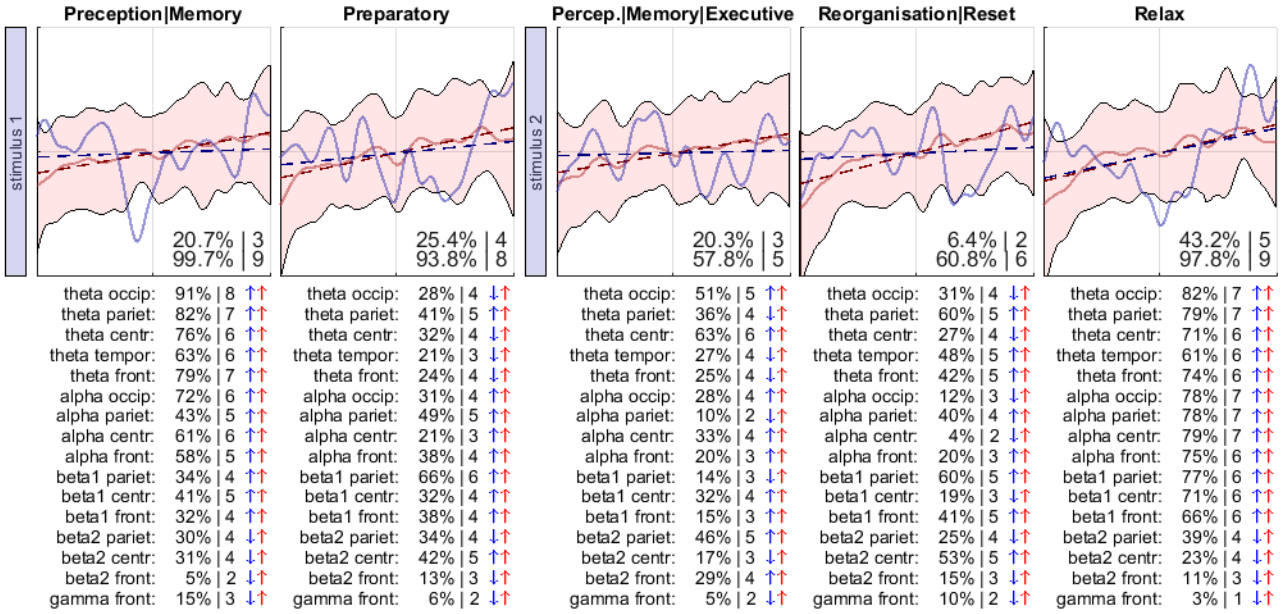
7. Vigilance and Vigilance decrement

Vigilance refers to the inner, unconscious readiness that enables the solving of tasks: It is the state of increased and permanent readiness to react. It is important to be able to maintain this state over a long period of time. During the concentration course test vigilance means to maintain this readiness to react adaptively over a long period of time according to the requirements. According to the resource model, the readiness to react can only be maintained as long as resources are available. Rising curves therefore indicate that resources can be retrieved, falling curves indicate low resource retrieval. In a detailed analysis it has been shown that the readiness to react does not have to be maintained uniformly during the task. Depending on the demands during task solving, more or less resources are retrieved. For this purpose, the solution process was divided into 5 segments: 1. perception, memory; 2. preparation; 3. perception, memory, action/action; 4 reset/reorganization; 5.relax. The individual data are compared with those of peers in terms of intensity of resource retrieval (slope) and stability of the solution process (variability).

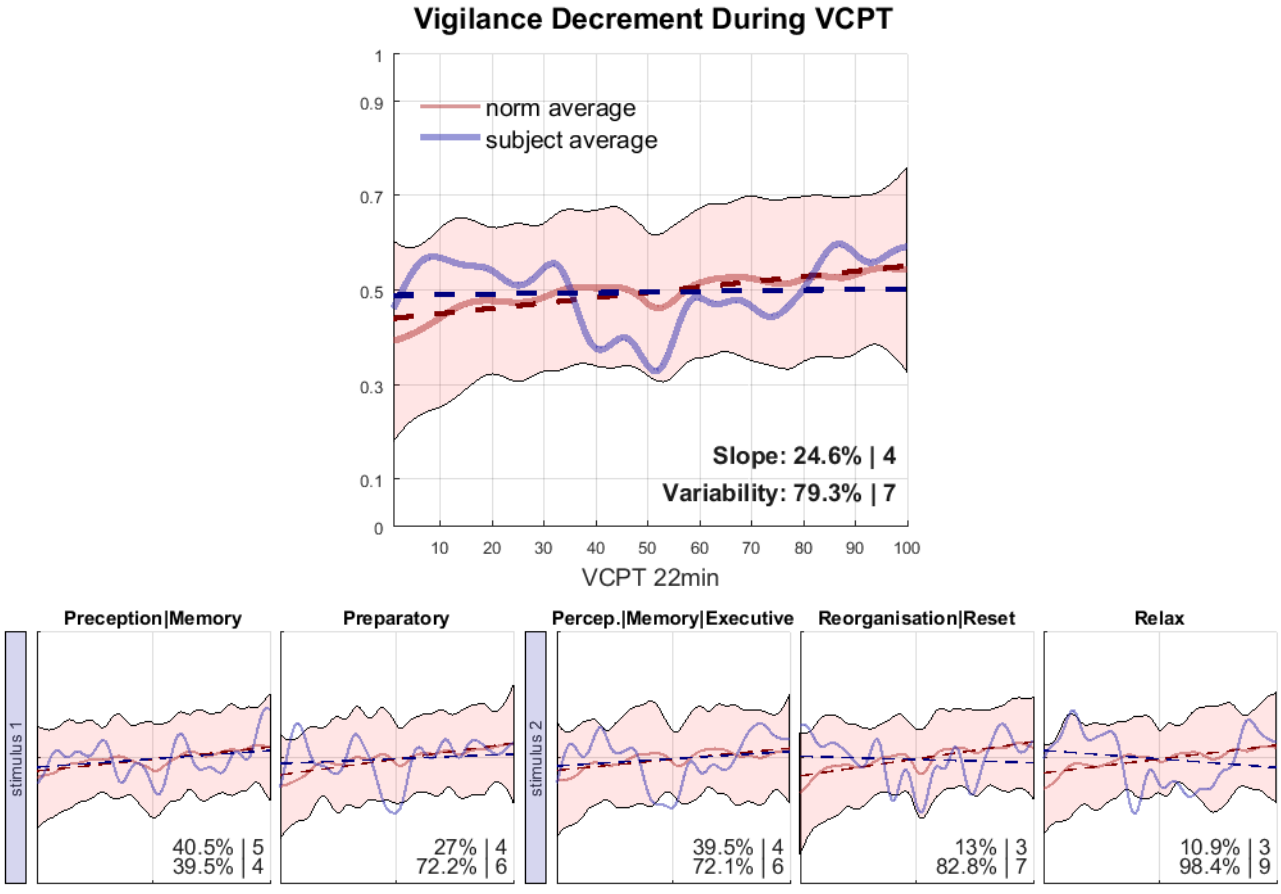
- Flat regression curve (Stanine: 1,2,3) show low resource load, low resources (low inner power) and low inner control (low prediction) (Assumption: ADHD, PTSD)
- Steep regression curve (Stanine: 7,8,9) show high resource load, high resources (high inner tension) and high inner control (high prediction) (Assumption: OCD, high tension, Depression, Anxiety)
- Low variability (Stanine: 1,2,3) means too high inner stability (Assumption: Rigidity, Autism)
- High variability (stanine: 7,8,9) means low inner stability (assumption: ADHD, PTSD)

Go

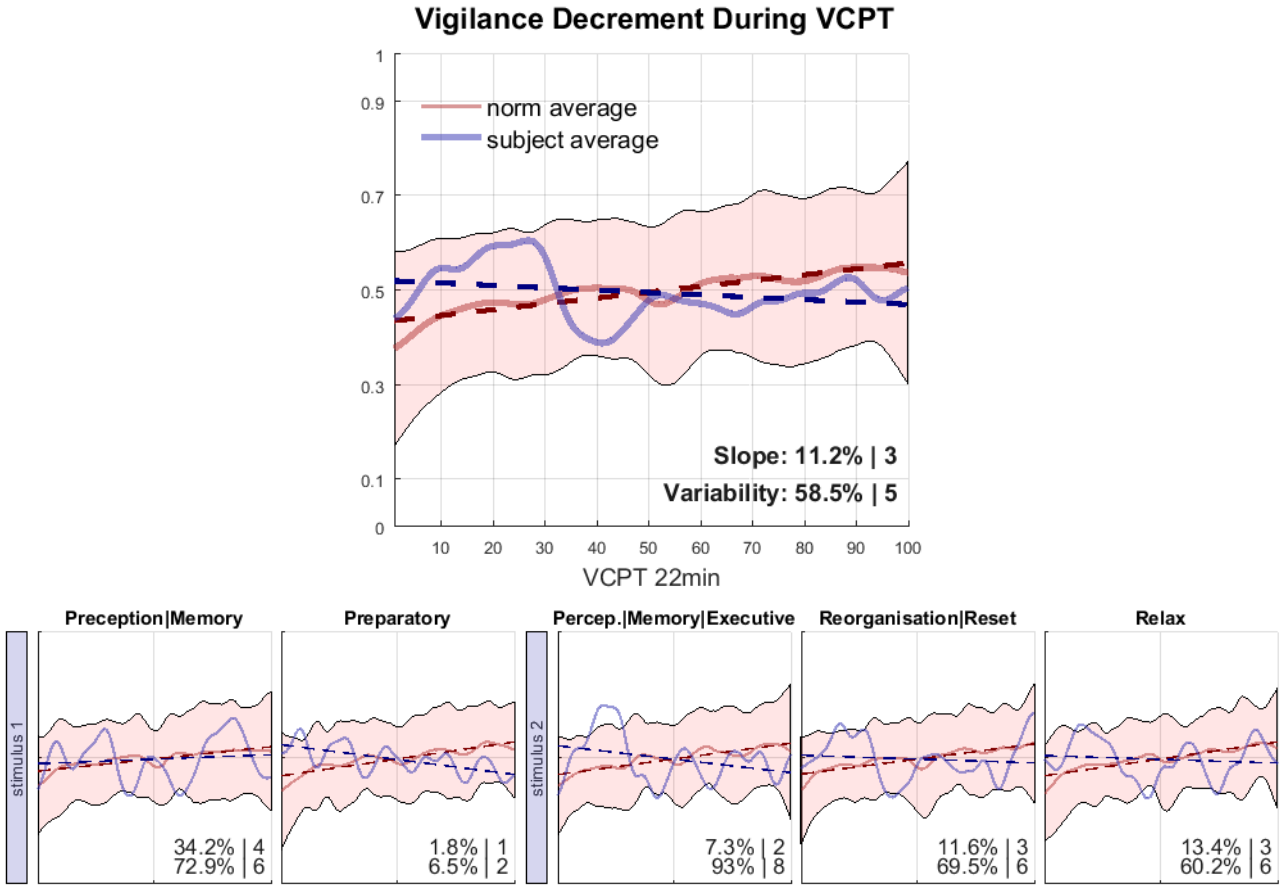



Preception|Memory
Preparatory
Percep.|Memory|Executive
Reorganisation|Reset
Relax
stimulus 1
stimulus 2
20.7% | 3
99.7% | 9
25.4% | 4
93.8% | 8
20.3% | 3
57.8% | 5
6.4% | 2
60.8% | 6
43.2% | 5
97.8% | 9
theta occip: 91% | 8 ↑↑
theta pariet: 82% | 7 ↑↑
theta centr: 76% | 6 ↑↑
theta tempor: 63% | 6 ↑↑
theta front: 79% | 7 ↑↑
alpha occip: 72% | 6 ↑↑
alpha pariet: 43% | 5 ↑↑
alpha centr: 61% | 6 ↑↑
alpha front: 58% | 5 ↑↑
beta1 pariet: 34% | 4 ↑↑
beta1 centr: 41% | 5 ↑↑
beta1 front: 32% | 4 ↑↑
beta2 pariet: 30% | 4 ↓↑
beta2 centr: 31% | 4 ↓↑
beta2 front: 5% | 2 ↓↑
gamma front: 15% | 3 ↓↑
theta occip: 28% | 4 ↓↑
theta pariet: 41% | 5 ↑↑
theta centr: 32% | 4 ↓↑
theta tempor: 21% | 3 ↓↑
theta front: 24% | 4 ↓↑
alpha occip: 31% | 4 ↑↑
alpha pariet: 49% | 5 ↑↑
alpha centr: 21% | 3 ↑↑
alpha front: 38% | 4 ↑↑
beta1 pariet: 66% | 6 ↑↑
beta1 centr: 32% | 4 ↑↑
beta1 front: 38% | 4 ↑↑
beta2 pariet: 34% | 4 ↓↑
beta2 centr: 42% | 5 ↑↑
beta2 front: 13% | 3 ↓↑
gamma front: 6% | 2 ↓↑
theta occip: 51% | 5 ↑↑
theta pariet: 36% | 4 ↓↑
theta centr: 63% | 6 ↑↑
theta tempor: 27% | 4 ↓↑
theta front: 25% | 4 ↓↑
alpha occip: 28% | 4 ↑↑
alpha pariet: 10% | 2 ↓↑
alpha centr: 33% | 4 ↑↑
alpha front: 20% | 3 ↑↑
beta1 pariet: 14% | 3 ↓↑
beta1 centr: 32% | 4 ↑↑
beta1 front: 15% | 3 ↑↑
beta2 pariet: 46% | 5 ↑↑
beta2 centr: 17% | 3 ↓↑
beta2 front: 29% | 4 ↑↑
gamma front: 5% | 2 ↓↑
theta occip: 31% | 4 ↓↑
theta pariet: 60% | 5 ↑↑
theta centr: 27% | 4 ↓↑
theta tempor: 48% | 5 ↑↑
theta front: 42% | 5 ↑↑
alpha occip: 12% | 3 ↓↑
alpha pariet: 40% | 4 ↑↑
alpha centr: 4% | 2 ↓↑
alpha front: 20% | 3 ↑↑
beta1 pariet: 60% | 5 ↑↑
beta1 centr: 19% | 3 ↓↑
beta1 front: 41% | 5 ↑↑
beta2 pariet: 25% | 4 ↓↑
beta2 centr: 53% | 5 ↑↑
beta2 front: 15% | 3 ↓↑
gamma front: 10% | 2 ↓↑
theta occip: 82% | 7 ↑↑
theta pariet: 79% | 7 ↑↑
theta centr: 71% | 6 ↑↑
theta tempor: 61% | 6 ↑↑
theta front: 74% | 6 ↑↑
alpha occip: 78% | 7 ↑↑
alpha pariet: 78% | 7 ↑↑
alpha centr: 79% | 7 ↑↑
alpha front: 75% | 6 ↑↑
beta1 pariet: 77% | 6 ↑↑
beta1 centr: 71% | 6 ↑↑
beta1 front: 66% | 6 ↑↑
beta2 pariet: 39% | 4 ↓↑
beta2 centr: 23% | 4 ↓↑
beta2 front: 11% | 3 ↓↑
gamma front: 3% | 1 ↓↑

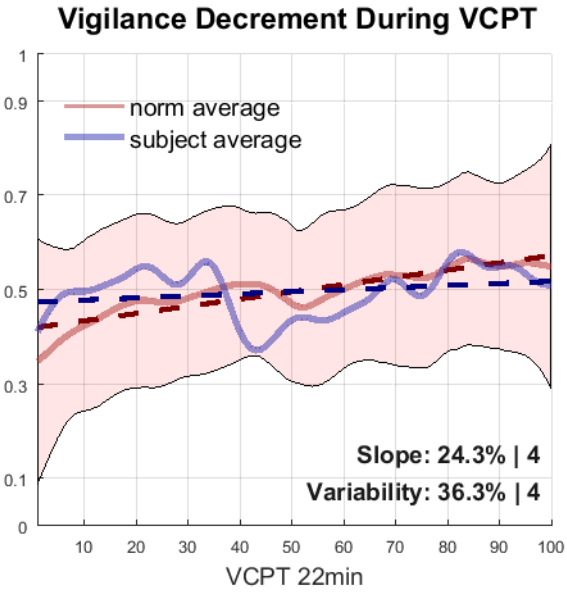
NoGo

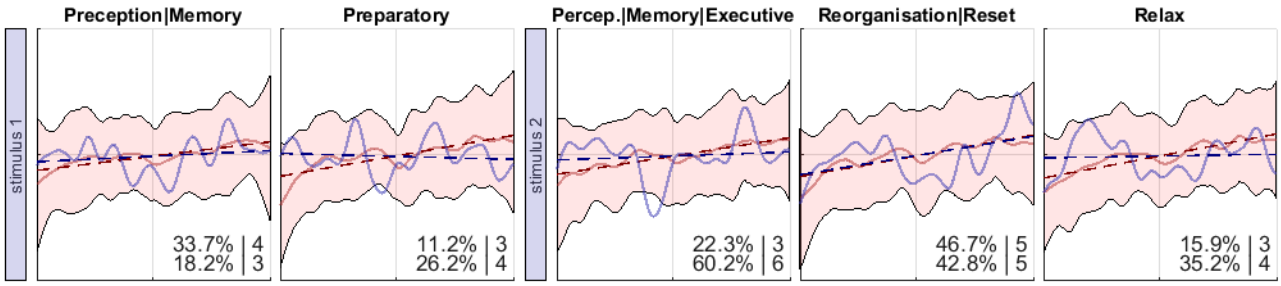

Vigilance Decrement During VCPT
norm average
subject average
Slope: 24.6% | 4
Variability: 79.3% | 7
VCPT 22min
Preception|Memory
Preparatory
Percep.|Memory|Executive
Reorganisation|Reset
Relax
stimulus 1
stimulus 2
40.5% | 5
39.5% | 4
27% | 4
72.2% | 6
39.5% | 4
72.1% | 6
13% | 3
82.8% | 7
10.9% | 3
98.4% | 9

Ignore



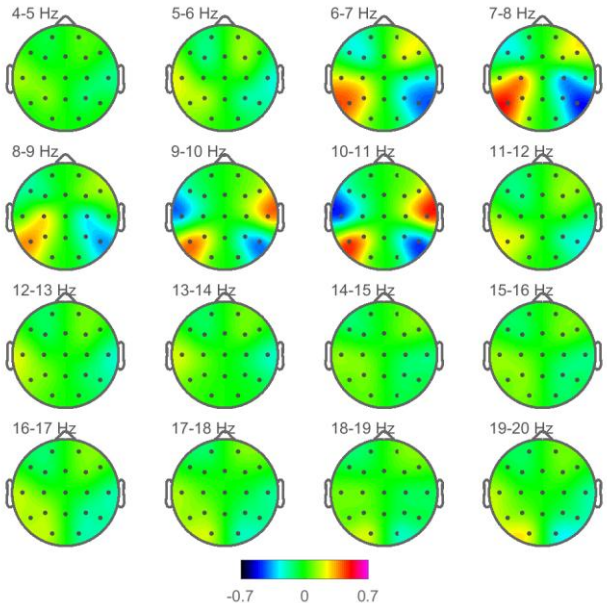
Ignore + Novelty



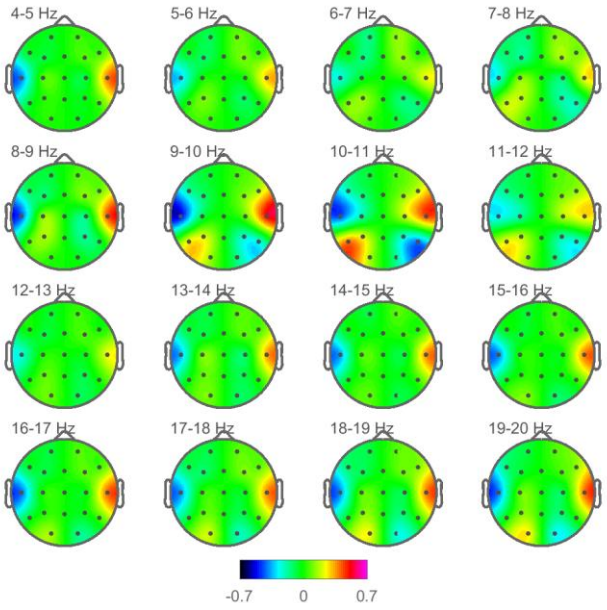

Preception|Memory
Preparatory
Percep.|Memory|Executive
Reorganisation|Reset
Relax
stimulus 1
stimulus 2
33.7% | 4
18.2% | 3
11.2% | 3
26.2% | 4
22.3% | 3
60.2% | 6
46.7% | 5
42.8% | 5
15.9% | 3
35.2% | 4

Asymmetry

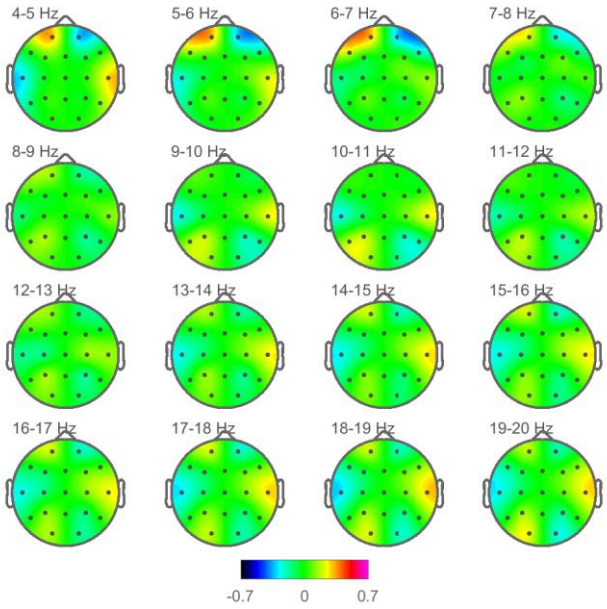
Asymmetry eyes closed:



Asymmetry eyes open:



Asymmetry VCPT:

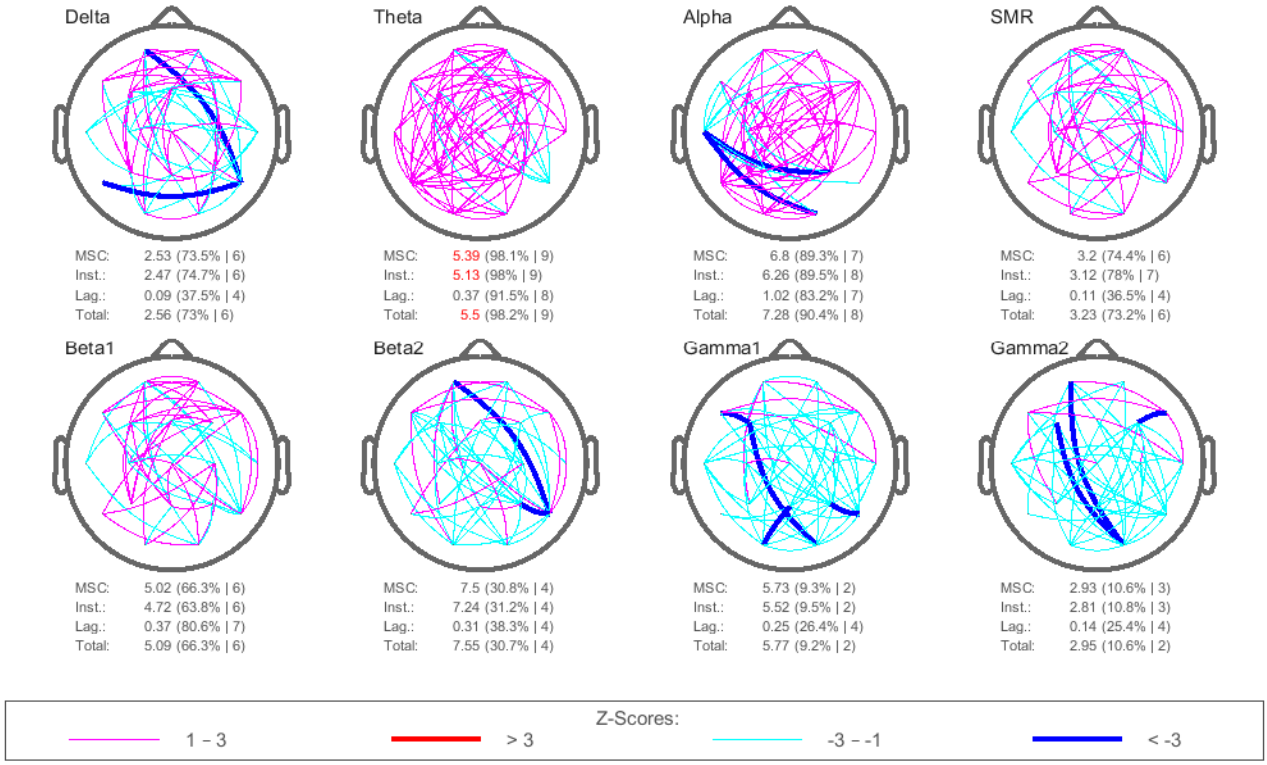


Significant asymmetry in the temporal, central, temporal-parietal areas

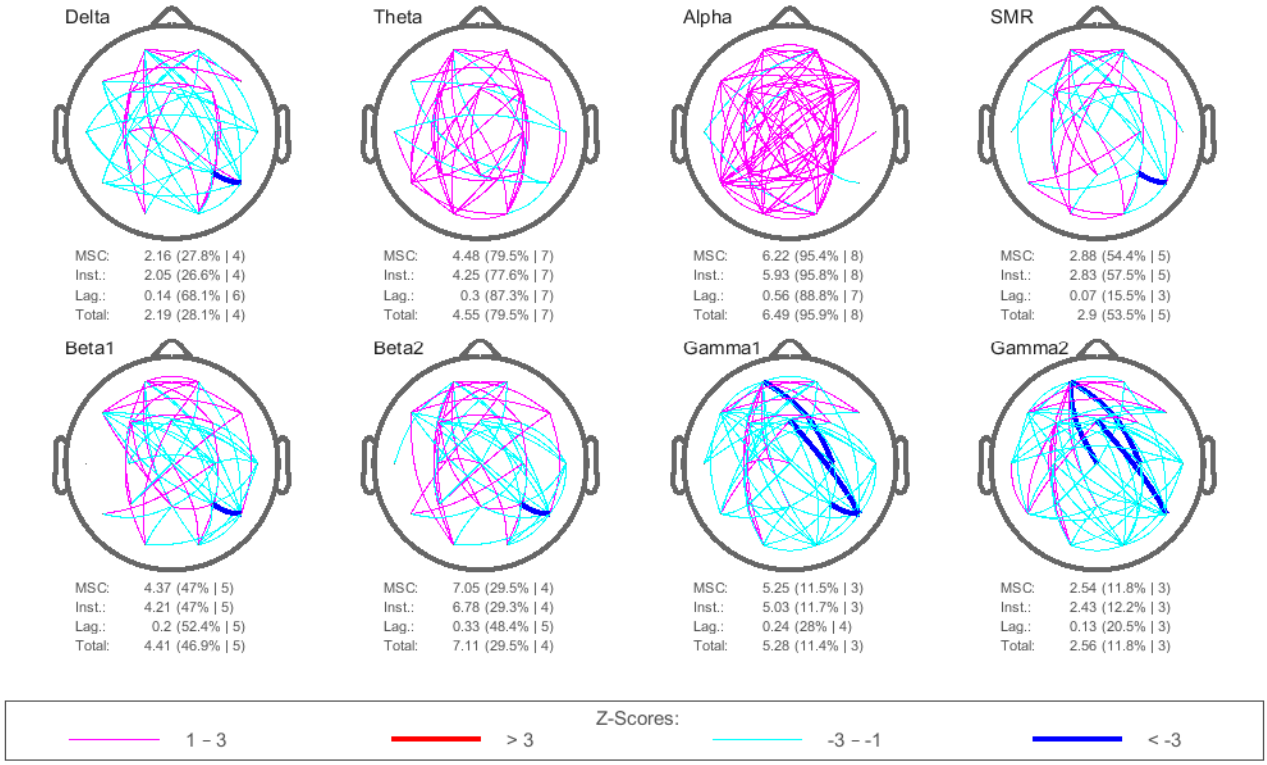
Coherence

The coherence analysis is a measure of the relationship of various structures in the cortex. The coherence analysis provides a ratio of the correlation of a specific frequency range. Violet and red lines represent excessive positive correlations, light blue and dark blue lines represent excessive negative correlations. Excessive positive correlations suggest that there is over-communication between the sites. Excessive negative correlations suggest that there is a lack of communication between the sites.

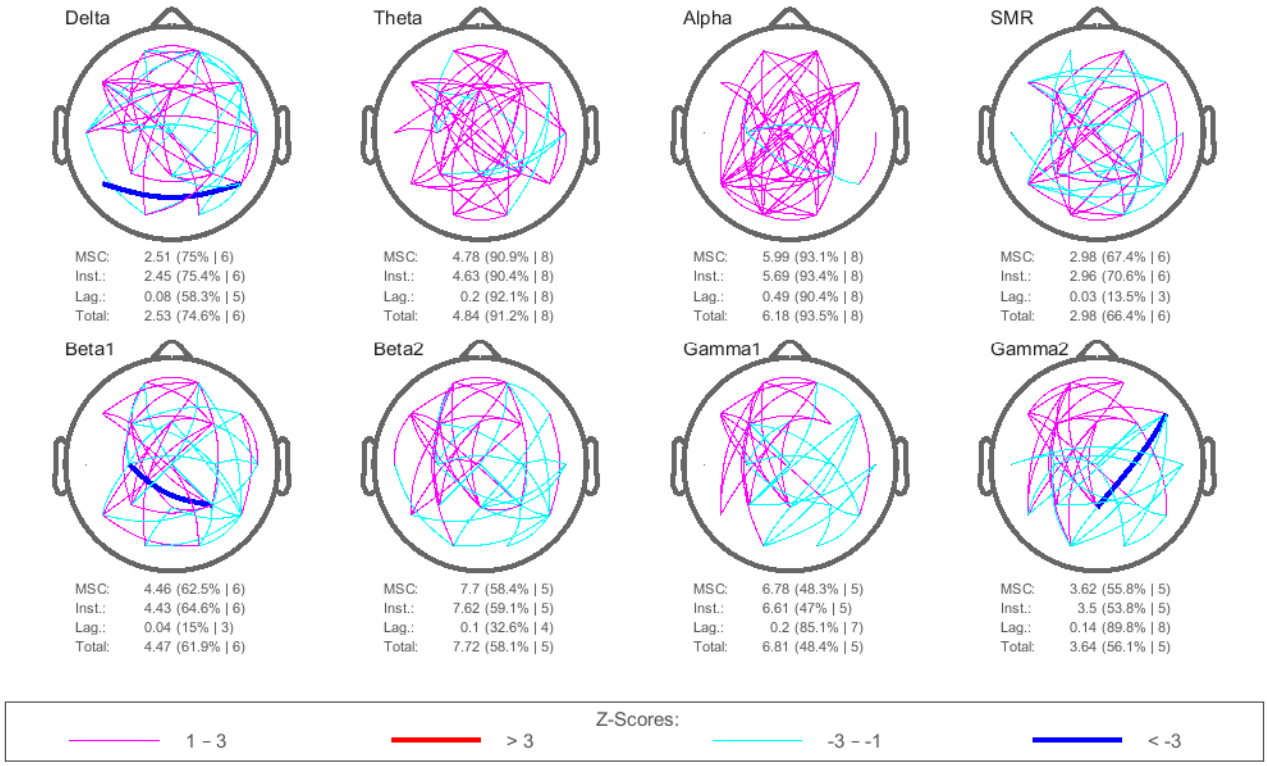
Coherence in eyes closed condition:



Coherence in eyes open condition:



Coherence in VCPT condition:


Delta
MSC: 2.51 (75% | 6)
Inst.: 2.45 (75.4% | 6)
Lag.: 0.08 (58.3% | 5)
Total: 2.53 (74.6% | 6)
Theta
MSC: 4.78 (90.9% | 8)
Inst.: 4.63 (90.4% | 8)
Lag.: 0.2 (92.1% | 8)
Total: 4.84 (91.2% | 8)
Alpha
MSC: 5.99 (93.1% | 8)
Inst.: 5.69 (93.4% | 8)
Lag.: 0.49 (90.4% | 8)
Total: 6.18 (93.5% | 8)
SMR
MSC: 2.98 (67.4% | 6)
Inst.: 2.96 (70.6% | 6)
Lag.: 0.03 (13.5% | 3)
Total: 2.98 (66.4% | 6)
Beta1
MSC: 4.46 (62.5% | 6)
Inst.: 4.43 (64.6% | 6)
Lag.: 0.04 (15% | 3)
Total: 4.47 (61.9% | 6)
Beta2
MSC: 7.7 (58.4% | 5)
Inst.: 7.62 (59.1% | 5)
Lag.: 0.1 (32.6% | 4)
Total: 7.72 (58.1% | 5)
Gamma1
MSC: 6.78 (48.3% | 5)
Inst.: 6.61 (47% | 5)
Lag.: 0.2 (85.1% | 7)
Total: 6.81 (48.4% | 5)
Gamma2
MSC: 3.62 (55.8% | 5)
Inst.: 3.5 (53.8% | 5)
Lag.: 0.14 (89.8% | 8)
Total: 3.64 (56.1% | 5)
Z-Scores:
1 – 3
> 3
-3 – -1
< -3

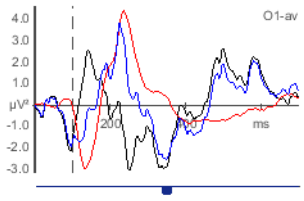
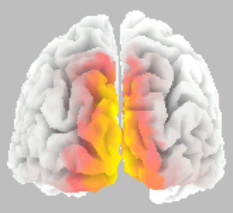
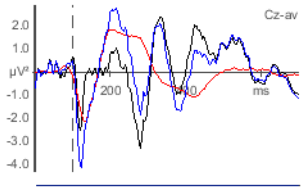
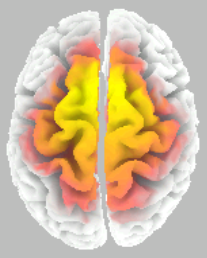
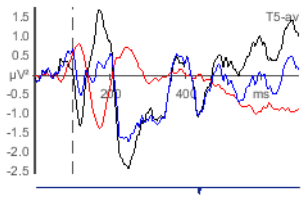
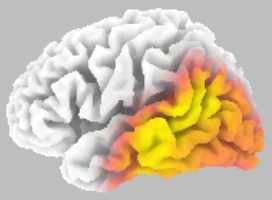
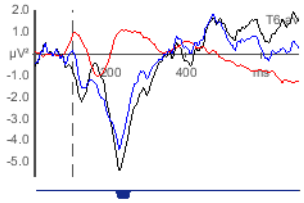
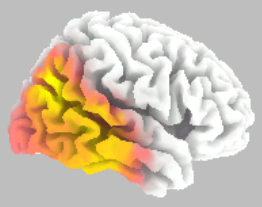
8. Evoked Potentials (in continuous performance task)

The images of the evoked potentials are relevant to information processing in different regions of the brain during the presentation of simple stimuli. In the various potentials, only specific neuronal groups and networks are involved.

Comparison of the components with database:

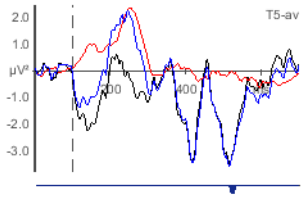
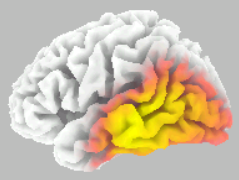
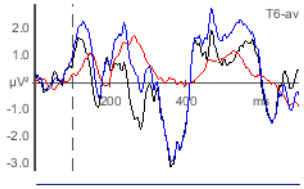
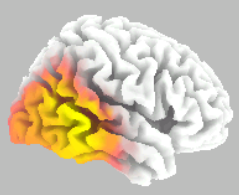
Input areas:

blue: client/red: database/black: difference (significance)

P1N1 Visual Input		*Brodmann area 19* *Cuneus* *Occipital Lobe* *Best Match at 5mm* *Brodmann area 18* *Cuneus* *Occipital Lobe*	
N1P2 Auditory Novelty		*Brodmann area 6* *Superior Frontal Gyrus* *Frontal Lobe* *Best Match at 17mm* *Brodmann area 8* *Superior Frontal Gyrus* *Frontal Lobe*	
P1N1 vTL left Association areas		*Brodmann area 22* *Superior Temporal Gyrus* *Temporal Lobe* *Best Match at 7mm* *Brodmann area 40* *Supremargial Gyrus* *Temporal Lobe*	
P1N1 vTR right Association areas		*Brodmann area 39* *Angular Gyrus* *Parietal Lobe* *Best Match at 9mm* *Brodmann area 40* *Inferior Parietal Lobule* *Parietal Lobe*	

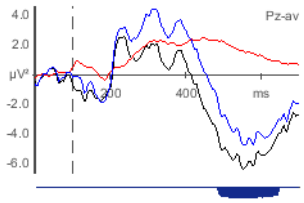
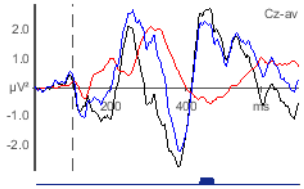
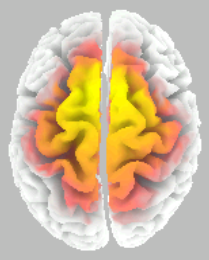
Memory areas:

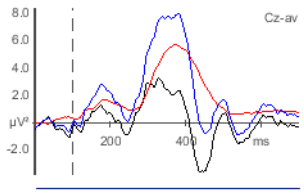
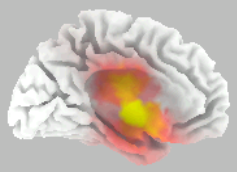
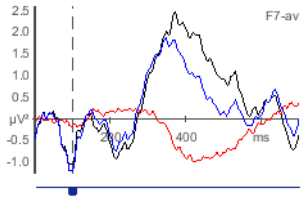
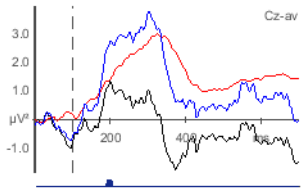
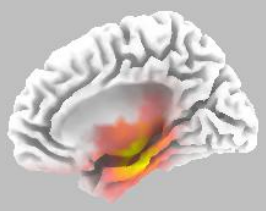
blue: client/red: database/black: difference (significance)

V com TL left Memory areas		*Brodmann area 21* *Middle Temporal Gyrus* *Temporal Lobe* *Best Match at 7mm* *Brodmann area 22* *Middle Temporal Gyrus* *Temporal Lobe*	
V com TR right Memory areas		*Brodmann area 21* *Middle Temporal Gyrus* *Temporal Lobe* *Best Match at 5mm* *Middle Temporal Gyrus* *Temporal Lobe*	

Executive function areas:

blue: client/red: database/black: difference (significance)

P3b Engagement		*Brodmann area 6* *Medial Frontal Gyrus* *Frontal Lobe* *Best Match at 5mm* *Brodmann area 5* *Paracentral Lobule* *Frontal Lobe*	
P3a Inhibition/Suppression		*Brodmann area 6* *Superior Frontal Gyrus* *Frontal Lobe* *Best Match at 17mm* *Brodmann area 8* *Superior Frontal Gyrus* *Frontal Lobe*	

P4 monCC Monitoring		*Brodmann area 25* *Anterior Cingulate* *Limbic Lobe* *Best Match at 15mm* *Brodmann area 34* *Subcallosal Gyrus* *Frontal Lobe*	
P4wmF Working Memory		*Brodmann area 34* *Parahippocampus Gyrus* *Limbic Lobe* *Best Match at 5 mm* *Brodmann area 28* *Parahippocampal Gyrus* *Limbic Lobe*	
SW PHC Slow Wave Activity This component reflects a part of limbic system activity		*Brodmann area 28* *Parahippocampal Gyrus* *Limbic Lobe* *Best Match at 5 mm* *Brodmann area 34* *Parahippocampal Gyrus* *Limbic Lobe*	

Shown are various deviations from the norm:

P1N1 - Visual Input:
Mid potentials: Early latency, High amplitude (negative &positive)

P1N1 vTR - right Association areas:
Mid potentials: High amplitude (negative &positive)

V com TL - left Memory areas:
Late potentials: Long-lasting high amplitude
Unusual curve progression

P3b - Engagement:
Late potentials: Long-lasting high amplitude

P3a - Inhibition/Suppression:
Late potentials: Reactivation

P4wmF - Working Memory:
-- abnormal

SW PHC - Slow Wave Activity:
-- abnormal

CNV - Readiness Potential
Mid potentials: High amplitude (negative &positive)

P1N1 - Visual input

The activation of primary visual areas informs about the quality of picture decoding into neurophysiological signals.

Mid potential

Latency provides information about processing speed while amplitude provides information about the intensity of information processing. Ano Nymous shows fast and intense processing. This is an expression of fast, intense and sensitive visual processing. By according to suppression processes this may lead to hypersensitivity.

P1N1 vTR - Right association areas

The association areas in right superior temporal cortex and right parietal cortex receive input from the occipital cortex and other secondary sensory areas. Here information is integrated and processed with the influence of frontal control functions. This association process is defined through complex mechanisms with the goal of generating concepts that can be recognized in the future. This construction process is highly individual and is influenced by many factors including genes, biology and learning processes. According to the lateralized functions that have been attributed to the right hemisphere, in these association areas mostly synthesis and holistic orientation are promoted. **The right hemisphere is particularly relevant in spatial recognition and orientation, recognition of emotional content and patterns, tactile-kinesthetic processing, musical experience and cultural techniques, as it is involved in estimation of time and space.**

Mid potential

Mid potentials of the association areas relate to sensory-cognitive processing functions; the main goal of these is sustaining the information processing. By maintaining energy in association areas, the mid potentials are formed, this is why these are associated with attention processes.

High amplitudes in mid potentials of right association areas indicate that sensory-cognitive functions of the aforementioned skills proceed intensely. This leads in Ano Nymous to intense emotional-holistic processing, which is usually associated with strong emotional processes. The result is often intense emotional feelings, thoughts and behaviors.

V com TL - Left memory areas

The memory areas in left superior temporal cortex and left parietal cortex store information from association areas. These processes are influenced by frontal control functions. The process that happens in memory areas is partially identical to what happens in association areas, namely comparison operations that aim at recognizing percepts. The process of recognition is influenced by time and content. Understanding and learning is possible because of memory retrieval. According to brain lateralization research, the functions that are attributed to the left hemisphere in terms of memory are involved in the following skills: **Speech, reading, writing and detail-oriented calculation. The left hemisphere is also relevant for speech comprehension and detail-oriented listening.**

Late potential

Late potentials of comparison operations are related to control of one's own performance and are affected by emotional factors like security or insecurity. Emotional regulation is in this way essential for the outcome of retrieval processes.

In Ano Nymous, long lasting high amplitudes in late potentials of leftsided comparison operations are observed. This is associated with high activation of left-sided monitoring processes which is usually associated with a high degree of control and meticulous behavior in everyday life. This leads to exhaustion over time.

An unusual curve progression is observed in left memory areas. This suggests that left side memory processes should be assessed further.

P3b - Activation operation

Executive functions/activation: There are two kinds of activation that are regulated by the Reticular formation: tonic and phasic activation. The tonic system of the reticular formation regulates through the hippothalamus the excretion of (nor-)adrenalin and serotonin neurotransmitters, what leads to long lasting tonic activation and modulation of cortical activity, e.g. influencing the day-night cycle.

The centre of the phasic system is located in the medial thalamus and is responsible for short-term activation of singular parts of the cortex, what is basically the activity we are measuring. Reticular structures are thin layers that cover the thalamic nuclei of sensory organs that send projections to the cortex. Non-specific reticular structures are activated here through convergent sensory pathways. The thalamus works as a switchboard of information and has a less general effect upon the cortex compared to the reticular formation; instead the thalamus exerts a selective effect upon specific cortical areas, being able to concurrently activate some areas and shielding others.

The activation operation is relevant as it enables goal-oriented performance. Hereby the cortex is optimally activated in order to achieve the desired goals. We differentiate among early, mid and late phases of activation.

Late potential

Late potentials of activation operation contain both a phasic and a tonic part. The tonic activation is related to the general activation and readiness to respond of the cortex. Emotional regulation is also relevant to the activation of late potential.

Long lasting high amplitudes in activation operations are usually observed related to a high level of inner involvement, either due to intense conflicts or intense emotional processing. Late high amplitudes are often accompanied by abnormalities in the tonic activation system (too high activation).

P3a - Inhibition/Suppression

Executive functions/inhibition/suppression/selection: This function is highly relevant not only for motor and cognitive (perceptual) control, but also for emotional behavior. Inhibition is a fundamental function of neuronal networks, which regulate the planning, execution and control of different processes. These functions are involved in all processes as inhibition (suppression) of processes represents a fundamental part of neurobiological networks. The **Inhibition** phenomenon works by influencing a neuron through an impulse that prevents the occurrence of an action potential, meaning that it impedes the firing of the neuron. Synaptic inhibition can occur be either pre- or post-synaptic inhibition. This inhibition function is localized in the fronto striatal loop (cortex-basal ganglia-thalamus-cortex).

Late potential

Late potentials of suppression and inhibition are influenced by emotional parts that are integrated in decision processes. The monitoring function is also involved.

Reactivation of suppression and inhibition process during information processing is a sign of difficulties in the course of selection processes. This applies also to decision making processes.

P4wmF - Working memory

Dorsolateral prefrontal activation (Working memory): Research regarding abnormalities in this component is currently scarce. Through different studies we know that several parts of emotional regulation influence working memory and cognitive content. This function is also strongly connected to executive functions.

SW PHC - Rhythmic slow activity

Limbic activity represented by rhythmic slow frequencies in parahippocampus: The parahippocampal complex (enthorinal cortex) is part of the limbic system and receives information from the amygdala (via insula) which is then sent to the hippocampal system. Particularly emotional information is processed and relayed in these systems.

CNV - readiness potential

The readiness potential is an indicator of the activation and preparation processes for the next stimulus. Here, the initiation of a motor movement is significant. It is measured in the central parietal cortex. See Walter, Cooper, et al (1964); Gaillard, A.W.; Näätänen, R. 1976); Thigpen, N.N., Keil, A. (2017). the readiness potential has an early component modulated by noradrenergic systems and a late component thought to be related to motor readiness and under dopaminergic control (cf Rohrbaugh, et al 1986; Birbaumer, et al, 1990).

Mid potential

High amplitudes mean that the brain prepares more intensively for the next stimulus.

9. Event related potentials – ERPs

Total number of trials: **398** (a-a GO: **100**, a-p NoGO: **100**, p-p: **99**, p-h: **99**, +: **200**, -: **198**, a-p-a-a: **0**)
Number of processed trials: **393** (a-a GO: **99**, a-p NoGO: **98**, p-p: **99**, p-h: **97**, +: **200**, -: **197**, a-p-a-a: **98**)

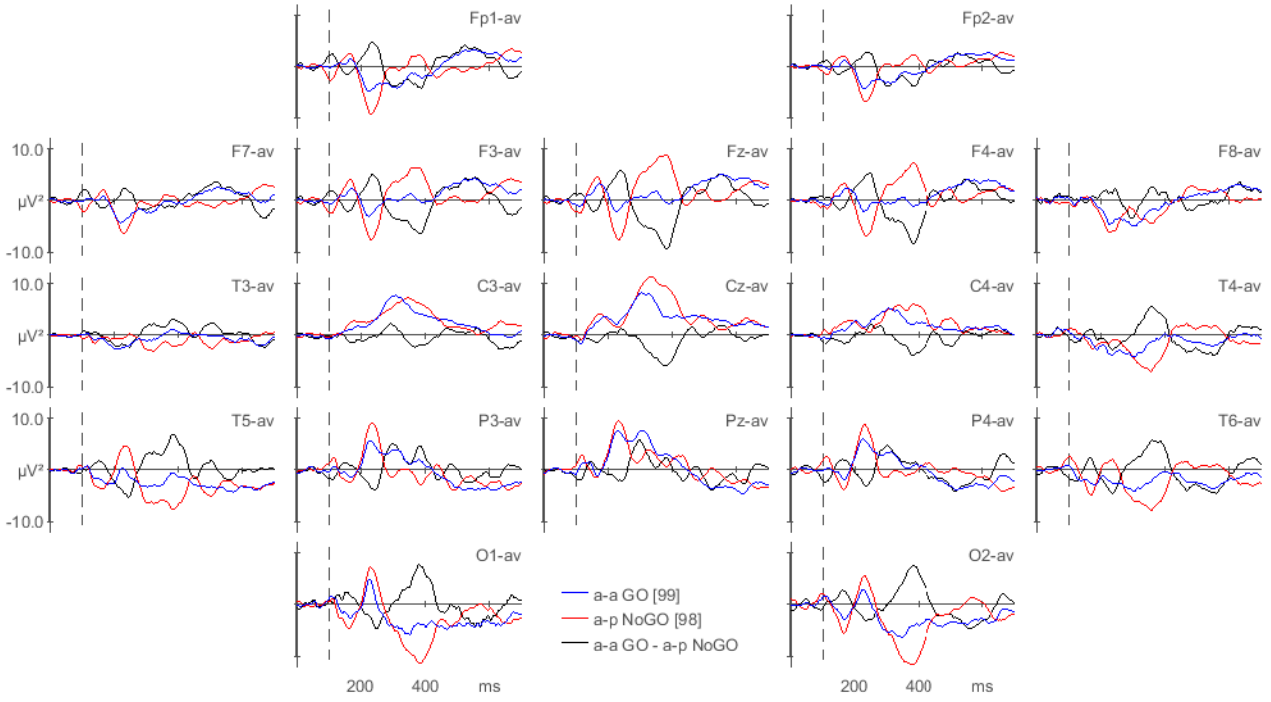
ERP Components

Comparison of the client's GO and NoGO ERPs computed for the second stimulus.

ERPs in the GO-NoGO task computed for GO, NoGO stimuli and ERP differences (GO- NoGO) are presented below.

blue: GO/red: NoGO data/black: difference curve (GO-NoGO)

GO-NoGO:



Differences between GO-condition and NOGO-condition are observed in central cortex and superior temporal cortex. This indicates an ability to perceptually discriminate different situations.

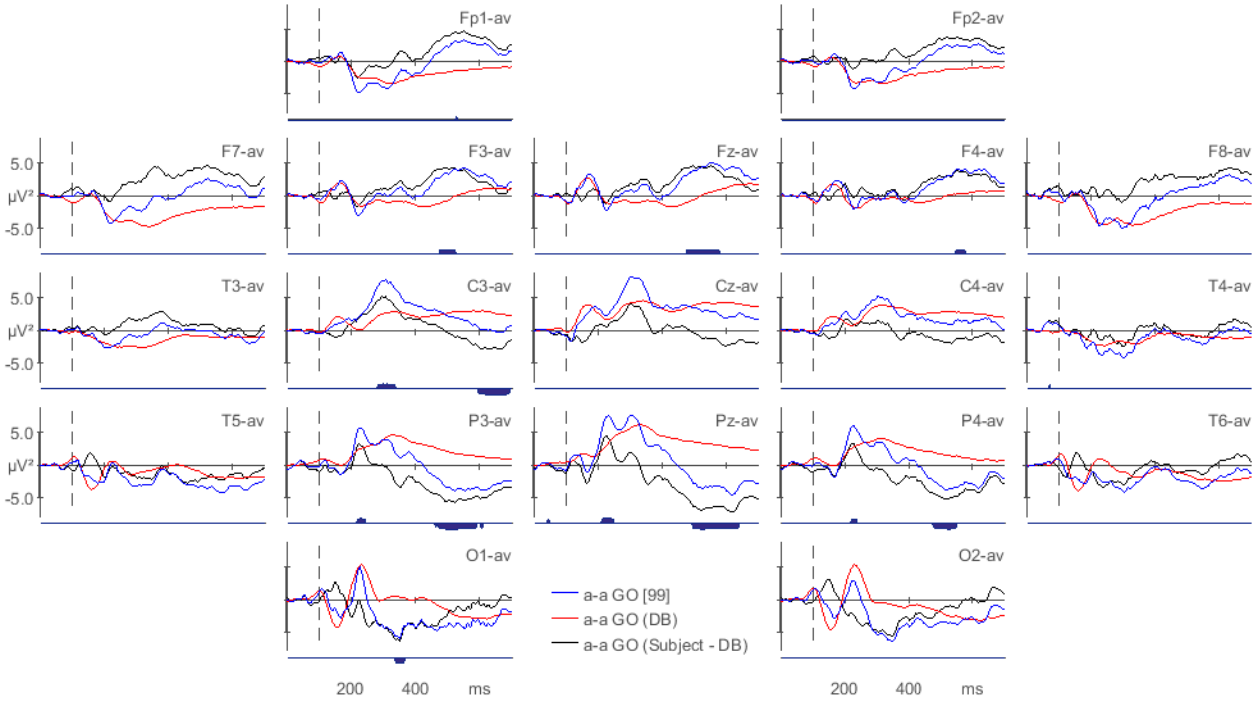
Simple ERPs

Comparison with the normative ERPs computed for the second stimulus.

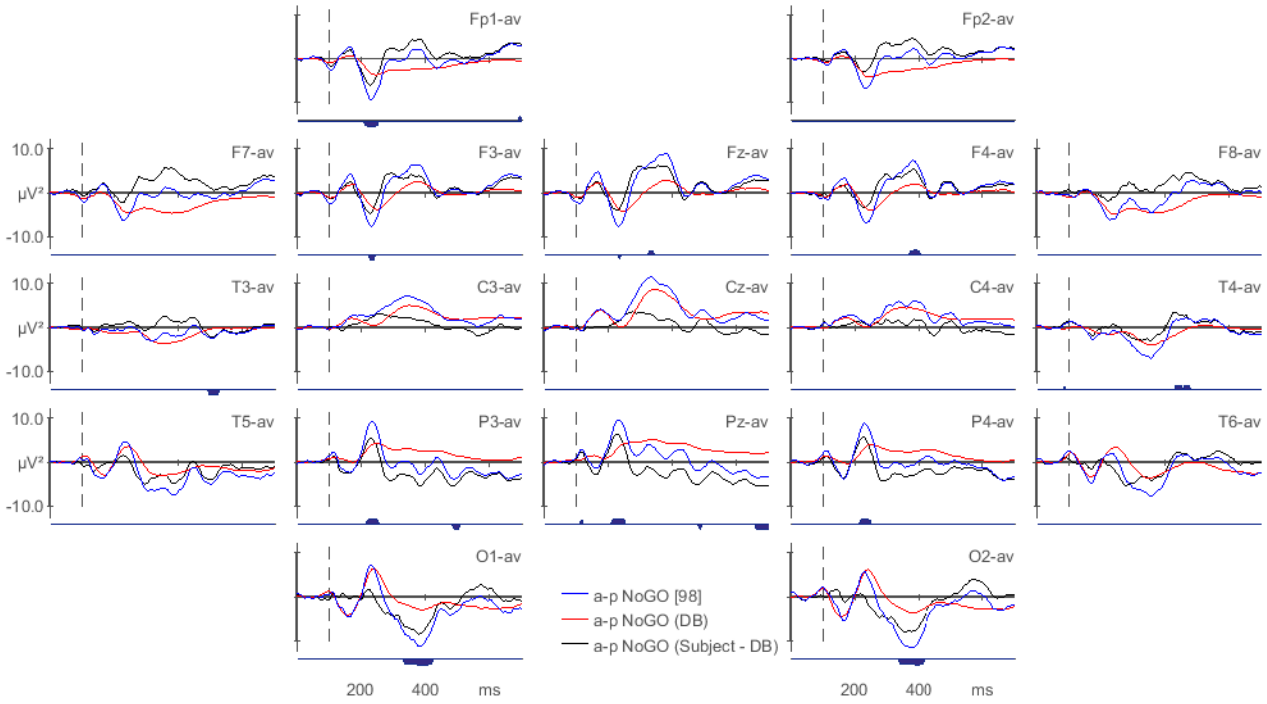
ERPs in the GO-NoGO task computed for GO, NoGO and Novelty (p-h) stimuli are presented on the next pages.

blue: subject/red: reference data/black: difference curve (significance)

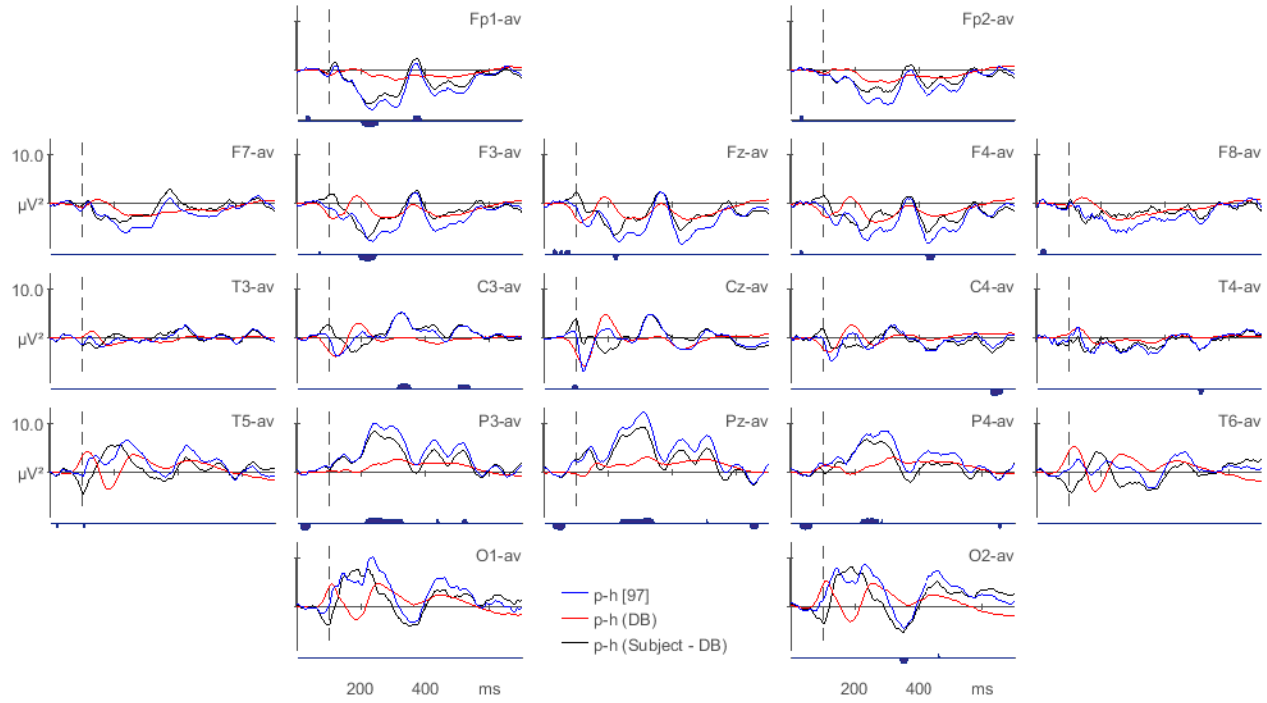
GO condition:



NoGO condition:



Novelty condition (p-h):



10. Diagnose-Algorithm

According to the medical tradition, a diagnosis is to be made on the one hand by the paternal suffering of the patients and, on the other hand, by evidence-based, objective diagnostic procedures. Focusing on neurophysiological characteristics implies that norms have been defined by a meticulous method according to scientifically recognized criteria and compared with patient groups. The patients included in the patient groups were all diagnosed by the usual criteria of the diagnostic and statistical manual (gold standard) as well as by experts. This allows a reliable definition of the patient group and its subtypes.

Psychopathology varies according to age and shows different characteristics depending on age group. Therefore, the patient groups must be divided into age groups. For each age group, the corresponding biomarkers are calculated and validated within the age group. This is done according to the following procedure: several hundred patients from several patient groups were subjected to standardized scientific examinations. This affects patient groups to attention disorders, learning disabilities, autism, depression, schizophrenia, obsessive-compulsive disorder, slight traumatic brain injury and stress disorders (patients after heart attack). For each of these patient groups, algorithms are developed for various age groups using complex statistical methods (big data, learning machines). For each individual patient, the probability of matching to the different patient groups can therefore be calculated using the algorithms. So far, there are algorithms for attention disorders as well as stress disturbances. Further algorithms follow 2017/2018.

Such an extended approach can provide support for diagnostics and statements regarding sensitivity and specificity. The probability of the diagnosis being accepted in percentages is calculated and output in the individual case. It is recommended that these markers be clinically validated in individual cases. However, the result of the algorithm comparison is not the clinical diagnosis!

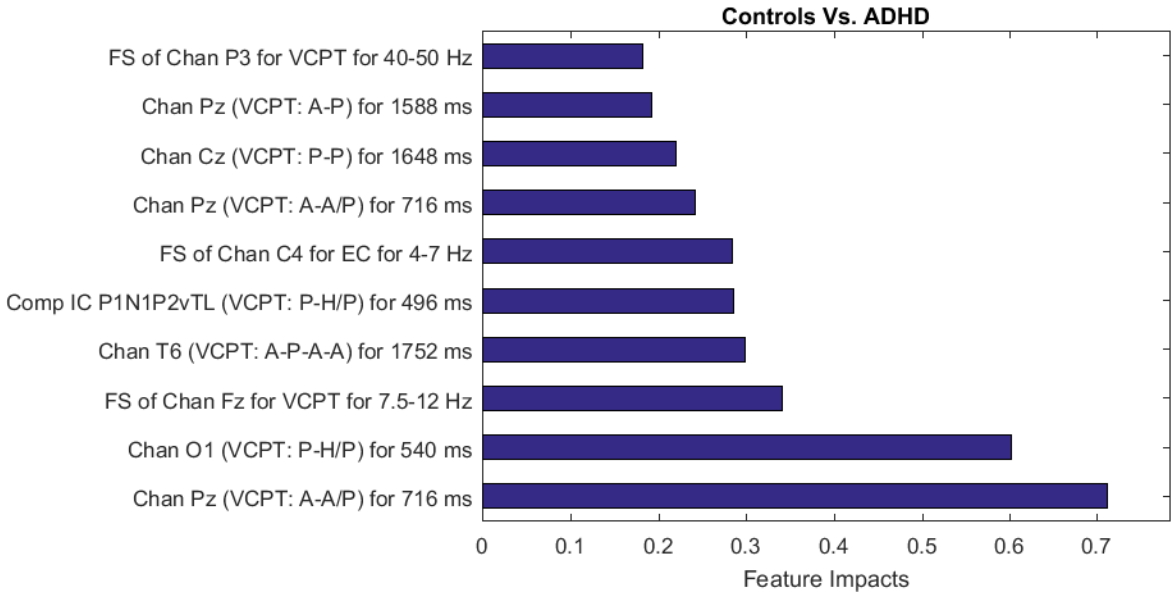
It is clinically evident that diagnoses are a generalization and thus always an approximation to the actual, individually very different processes and circumstances of the individual humans. This is currently the best possible representation of a membership of a patient group. Our data, which are not yet used in the clinical studies so far, help to better characterize the characteristics and to differentiate between the subtypes with consequences for prognosis and therapeutic measures, which is a step closer to the individual as a matter of fact and nevertheless experience values respectively. neurophysiological considerations. To this extent, it must also be emphasized once again that the information of the neurophysiological constellations represents a complementary mosaic piece of the findings which extends the previous diagnostics. It is also clear that the demarcation to other patient groups is necessary. This will be all the more possible, the more algorithms of other patient groups are present and the patient's affiliation to existing patient groups can be defined as precisely as possible. It is also clear that the quality of the algorithms is closely linked to patient numbers and patients in general. The higher the number of patients, the clearer the patient's diagnosis, the better the algorithms. Since the present algorithms are dynamic variables, they will be constantly updated over the next time.

ADHD-Diagnose-Index

The ADHD algorithm or ADHD index was realized in the context of the CH-ADHS project on three different samples. The following algorithm was used: Regularized Logistic Regression.

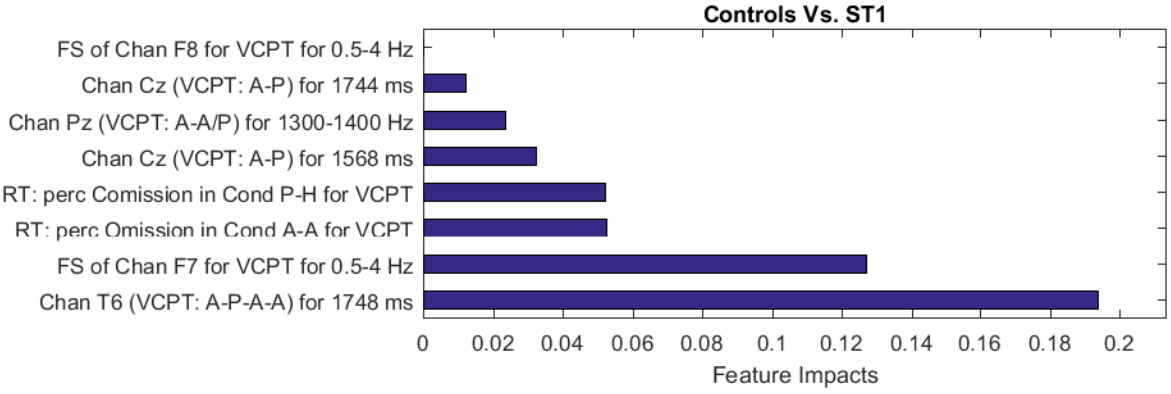
Ano Nymous belongs to the age group 18 – 67 y.o.

For Ano Nymous the following probability of belonging to this group is shown: **ADHD: 12%** - No significant match

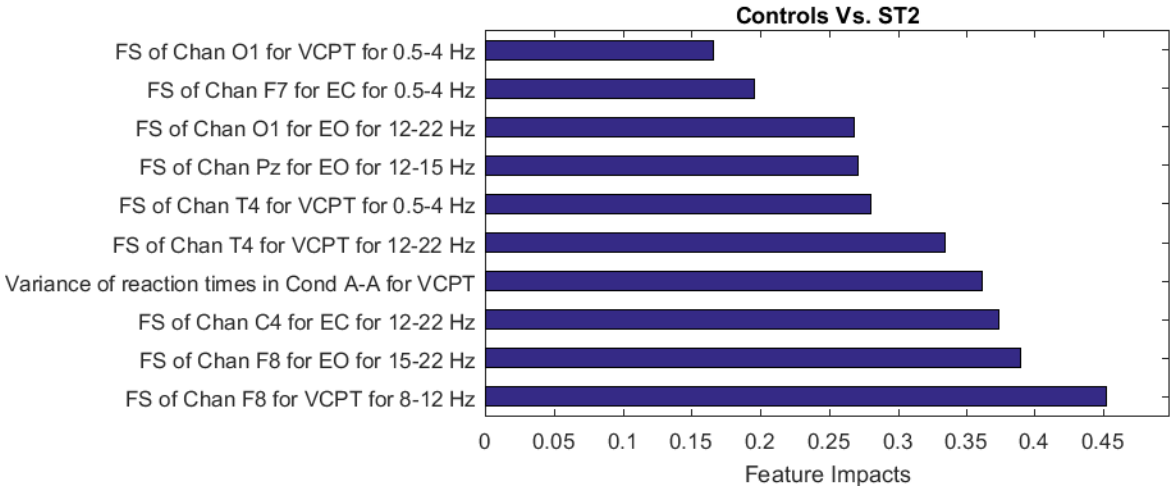


Subtype

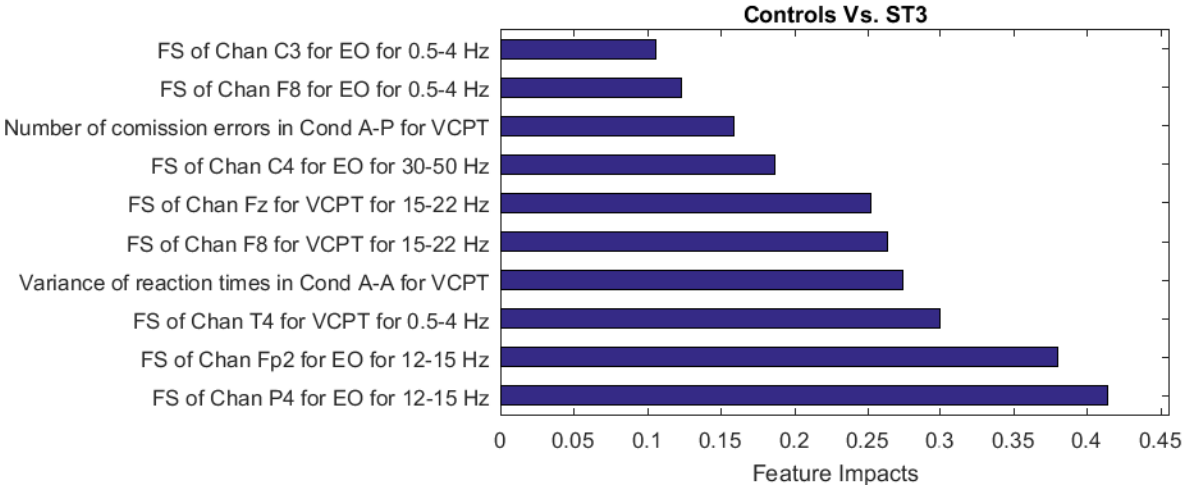
ST1: 18% - No match with dysfunctional ADHD networks



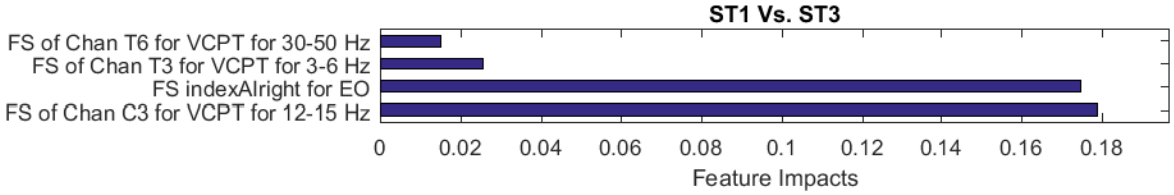
ST2: 22% - No match with dysfunctional ADHD networks



ST3: 13% - No match with dysfunctional ADHD networks



ST3 (ST1vsST3): 44% - Increased match with dysfunctional networks of the prefrontal cortex (vs. limbic system)



IV. Recommendations

We would like to point out that the therapeutic approach must be holistic and should include various aspects of life. This implies regarding not only cognition, behavior and emotions, but also biological aspects. How exactly this change-strategy should be designed is far beyond the scope of this report. However, we consider that difficulties must be addressed by a multimodal approach that takes into consideration aspects of both the individual and the surrounding social network.

1. Everyday Life/Work

General statement: a high grade of neurobiological potential for change is our basic principle. Thanks to worldwide, intensive research in the field of Neuroplasticity, we know that new neuronal connections can be formed in every area as long as the right information/stimulation is given. Consecutively, personalized interventions are listed which are based on research and rated highly important for processes of change.

Based on the findings of the examination, the following personalized measures are recommended to strengthen resilience and optimize daily functioning:

Establish consistent sleep-wake rhythms: The neurophysiological findings indicate patterns of cortical underactivation that can be significantly influenced by sleep quality and circadian rhythm stability. Maintaining fixed bedtimes and wake times (including weekends), avoiding screen exposure 90 minutes before sleep, and creating a calming evening routine (such as brief stretching or reading) supports optimal cortical activation patterns and cognitive performance throughout the day.

Implement structured cognitive work intervals: Given the intact vigilance and resource access demonstrated during examination, the person can benefit from intentionally designed work periods. Using 45-minute focused work blocks followed by 10-minute breaks with physical movement optimizes sustained attention and prevents cognitive fatigue. Setting clear start and end points for tasks, combined with environmental cue management (dedicated workspace, notification silencing), enhances executive functioning efficiency.

Utilize physical activity for arousal regulation: The examination revealed balanced arousal levels that can be actively maintained through regular physical exercise. Incorporating 20-30 minutes of moderate cardiovascular activity (brisk walking, cycling, swimming) four to five times weekly stabilizes internal activation levels, supports frontal lobe functioning, and counteracts cortical underactivation patterns identified in the neurophysiological assessment.

Create external structure through visual planning systems: To compensate for potential executive functioning vulnerabilities suggested by frontal underactivation patterns, implementing visible planning tools (wall calendars, task boards, digital reminders with auditory signals) provides external scaffolding for time management and task completion. Daily review of upcoming commitments each morning and brief evening planning sessions enhance organizational capacity.

Practice targeted stress modulation techniques: The limbic dysregulation markers identified during cognitive demand conditions indicate benefit from regular stress regulation practices. Brief diaphragmatic breathing exercises (4-6 breaths per minute for 5 minutes) performed twice daily, combined with progressive muscle relaxation before demanding tasks, supports emotional regulation and optimal cognitive performance.

Leverage temporal processing through auditory learning strategies: Given the temporal region information processing patterns observed, incorporating auditory learning modalities (podcasts, audiobooks, verbal discussion of material) alongside visual information enhances encoding and retrieval. Recording verbal summaries of important information and playing them back during physical activity combines multiple beneficial strategies.

Establish regular cognitive engagement through interest-based activities: Pursuing personally meaningful cognitive challenges (learning a language, musical instrument, complex hobbies) in low-pressure contexts promotes frontal activation, supports neuroplasticity, and builds cognitive reserve while maintaining motivation through intrinsic interest rather than external demand.

2. Medication

These medication recommendations are based merely on the reported neurobiological parameters. Different people react differently to medication. Especially side effects are hard to predict. The responsibility for any given medication lies in the hands of the prescribing medical doctor.

Medication should be recommended by clinical specialists

3. Additional recommendations

Psychotherapy coaching:

The psychotherapy coaching approach combines methods and positions of behavioral psychotherapy with the goal-oriented and structured manner of coaching. Understanding is combined with engaging agreements. Thereby new insights regarding one's abilities emerge. These new insights lead to new possibilities in everyday life: attributions of own abilities and skills are subject to change. This method can be combined with neurostimulation techniques.

Adolescents with this neurobiological constellation can develop issues with self- confidence, motivation, self-image, etc. Individual psychotherapy can be helpful.

Making several lifestyle changes can feel stressful if an individual is already experiencing over arousal and anxiety. Working with a therapist who can break down these changes into manageable pieces and encourage these efforts may be beneficial in the long term.

Neurofeedback:

Neurofeedback is a relatively new method and therefore still under debate in some circles. The underlying principle is simple: the patient learns about his/her own brain states by receiving this information through a screen as feedback. Hereby the patient learns how to recognize his/her internal states and how to modify these. In the US, the American Association of Pediatrics has granted the best level of support (Level 1) for the efficacy of this technique as an evident-based treatment for ADHD, meaning that neurofeedback has an efficacy comparable to medication. On the other hand, the European Society of Neurology has not adjudged the efficacy of this method to date. The payment of the therapy must be discussed for every individual case with the treating therapist.

The neurophysiological assessment of the 31-year-old patient reveals a complex pattern of cortical dysregulation. Theta/Beta ratios are within the normal range (stanine ≤6 at all sites), which argues against a classic ADHD-type dysregulation. Arousal values are predominantly within the optimal range, indicating balanced internal activation. The central–sensorimotor index shows normal processing patterns, and the vigilance analysis suggests normal access to cognitive resources.

However, several significant spectral deviations are present: a left temporal theta excess (T3: 7.08 Hz eyes open, 6.35 Hz eyes closed), serving as a neuromarker for information-processing and emotional dysfunctions; central and parietal alpha deviations (C3: 10.01 Hz, Pz: 10.25 Hz, T3: 10.74 Hz eyes open), indicating cortical underactivation; frontal alpha deviations (F3: 9.77 Hz eyes closed, F7: 10.50 Hz VCPT), reflecting reduced cognitive control; and frontal midline theta (F7: 6.84 Hz VCPT) as a marker of limbic dysregulation. ERP analysis shows preserved differentiation capacity without significant abnormalities.

Following protocols are indicated for this patient:

In the eyes opened condition
Fz/CZ– reinforce activity at (15-18 Hz) with subsequent decrease of low and high activity (3-15 and 18-30 Hz).
C3/C4– reinforce activity at (12-15 Hz) with subsequent decrease of low and high activity (3-12 and 15-30 Hz).
P3/P4– reinforce activity at (12-15 Hz) with subsequent decrease of low and high activity (3-12 and 15-30 Hz).
F3/F4– reinforce activity at (13-20 Hz) with subsequent decrease of low and high activity (3-12 and 15-30 Hz).
Pz/C4– reinforce activity at (12-15 Hz) with subsequent decrease of low and high activity (3-12 and 15-30 Hz).
P3/C3– reinforce activity at (12-15 Hz) with subsequent decrease of low and high activity (3-12 and 15-30 Hz).

In the eyes closed condition
O1-O1 – reinforce alpha activity (8 - 12 Hz)

ILF protocol

T4 – T3 – overall stabilization, ANS symptoms regulation
C3 – C4 – overall stabilization, ANS symptoms regulation
P3 - P4 – stabilization, balance, working memory, attentional stability, integration of auditory–visual information

Pz - T4 – grounding, reduces dissociative or “foggy” feeling, decrease anxiety, improve sensory filtering
T4 - Fp2 – control of emotions, fear, fronto-limbic connectivity, autonomic states
T4 – F8 - reduced emotional volatility, calmer affect, improved flexibility, self-awareness

Fp1 - T3 - mental calming, mood stabilization, short-term memory, organization, impulse control, and attention
F3 – T3 – OCD, reducing rumination and improving emotional and cognitive control.
T5 – T3 - stabilize emotional memory while improving language coherence, stabilize mood and improve verbal comprehension
P3 – T3 - stabilize emotional memory while improving language coherence, stabilize mood and improve verbal comprehension

Synchrony training can be recommended

Fz - Pz – 0.01 Hz

HRV training can be recommended

The protocols are given according to QEEG results and can be modified following the patient's condition and response to the therapy

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