

2.1 EVENT- RELATED DYNAMICS OF ALPHA BAND RHYTHMS :-

- In 1929, Berger performed the first human scalp recordings → when it was known that conscious experience may influence the EEG characteristics.

For eg:- At frequency between 8-13 Hz, i.e. the human alpha rhythm is generated during relaxed awake state • when the eyes are closed.
 however, • amplitude decreases when the eyes open.

NB:- In some cases, mental calculations may cause decrease of alpha rhythmic activity.

In electroencephalography, this decrease is called 'alpha blocking' or 'desynchronization'.

Eg of Einstein :-

In case of Einstein, while performing mathematical operations (which were fairly automatic for him) → represented fairly continuous alpha rhythm.

suddenly alpha rhythm dropped & he was restless.

→ reason was he found a mistake in the calculations (he made a day before).

This fact illustrates how concentration of attention is a special case of arousal, a local or focused waking response
 ↳ employing similar neuronal mechanisms.

Event related desynchronization :- (ERD)

↓ → (connected with thinking / conscious mental processes)

Apart from cognitive processing, voluntary movement may also cause desynchronization of the rhythms within the alpha frequency range, localized over somatosensory and motor areas

(of, relating to, ←
on being sensory

→ (the so-called mu
rhythms)

activity having its
origin elsewhere

than in the special sense organs; denoting sensation i.e pressure, pain etc which can occur anywhere in body in contrast to one localized at a sense organ) ↓

Event related Desynchronization (ERD)

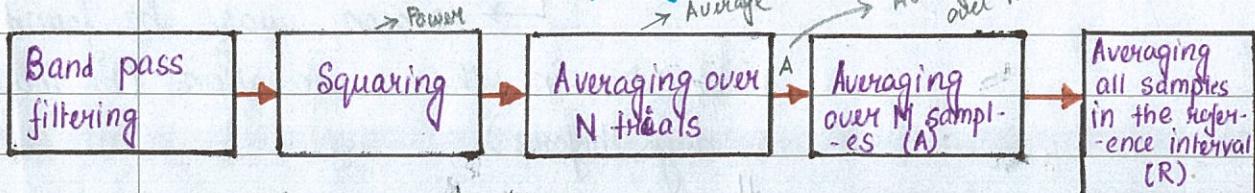
was introduced for the EEG power changes induced by some event. (e.g.: finger movement)

NB:- The authors 'Amanibar and Pfurtscheller' introduced / suggested the methods for ERD quantification.

To reduce an error in the estimate of event related power changes → a number of event triggered trials are necessary.

Computing event-related desynchronization (ERD) and an event-related synchronization (ERS)

consist of foll steps :-



$$\text{Calculating of ERD [\%]} = \frac{100(A - R)}{R}$$

Steps involved :-

↳ Scheme for computing ERD :-

- a) Raw EEG data are first band pass filtered. i.e. each trial is band pass filtered.
 - b) Each sample is then squared and averaged over all trials:
 - (i) The power within a band is computed by squaring amplitudes of filtered trials.
 - (ii) Average is taken over all trials.
 - c) Average power signals (A) are smoothed by averaging M consecutive power values.

→ To reduce the variance the power signals are averaged over M consecutive samples.
 - d) A reference power (R) is computed as a mean power in the reference period. [some seconds before an event]

$\{ \therefore \downarrow \text{reference power is computed using all samples in the reference period.} \}$
 - e) Finally, a power change (in percentage) with respect to reference power is computed according to the foll formula -
- $$\frac{100}{R} (A-R)$$
- ↓
- A power increase corresponds to an ERS
 - A power decrease corresponds to an ERD.

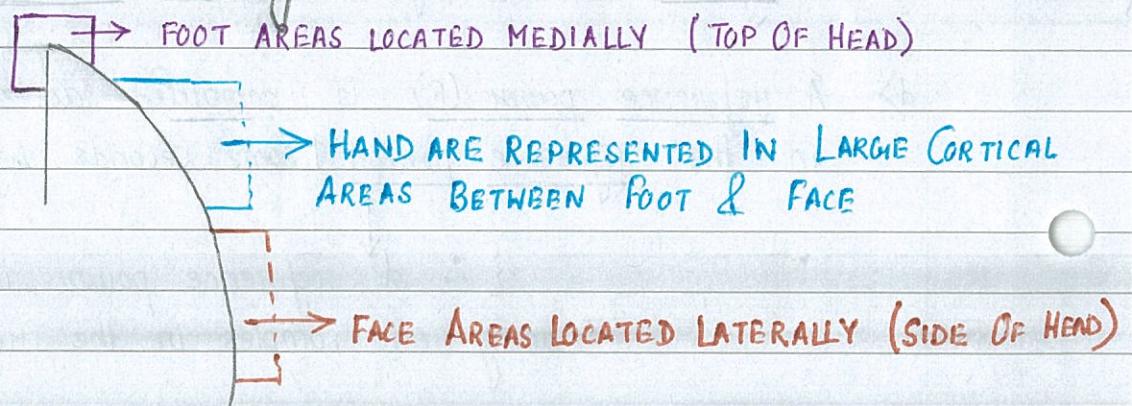
- $\frac{\text{ERD}}{\text{ERS}}$ → is also quantified in space by selecting a time point
↳ { computing ERD / ERS from multichannel data. }

Understanding of the figure relating "The spatial distribution of event-related changes in power of the mu-rhythms during voluntary movement of hand and foot."

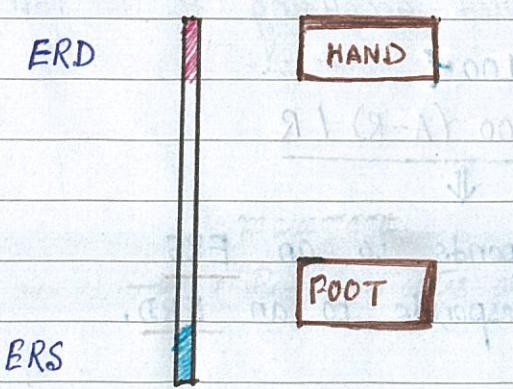
(mu-rhythms results due to desynchronization of the rhythms within alpha freq range because of voluntary movement)

a) Right Side of the Picture :-

- Schematic representation of the human body in the somatic sensory cortex.



b) Left Side of the Picture :-



→ Displaying synchronization & desynchronization of the α freq components during voluntary movement.

- 'Red' indicates areas with power decrease (ERD)
- 'Blue' with power increase (ERS)

c) Expectation :-

- During hand movement ERD (red color) occurs over hand areas.
- During foot movement ERD (red color) present over foot areas.

d) Actual :-

- In certain areas, the mu-power increases denoted by blue color.

• During hand movement synchronization of mu appears over foot area.

Similarly, ERD of foot area is surrounded by ERS of hand area.

→ In both cases, there is focal desynchronization surround synchronization pattern.

This fact is surprising because it is not expected that hand movement would influence the neuronal activity of the cortical area of the foot and vice versa.

NOTE :- The above mentioned pattern appears not only during movement but also already present during movement planning.

2.2

Absence SEIZURES :-

- ↓ • An absence seizure causes a short period of "blanking out" on staring into space.
- Like other kinds of seizures → they are caused by abnormal activity in a person's brain.
- Absence epilepsy is also called 'petit mal' seizures.

NB:- There are 2 types of absence seizures :-

a) Simple absence seizures :- During a simple absence seizure, a person usually just stares into space for less than 10 secs.

∴ it is not easy to notice simple absence seizures

b) Complex absence seizures :- In this case, in addition to staring into space, a person will make some kind of movement like blinking, chewing, hand gestures etc.

It can last up to 20 secs.

- Absence seizures can also happen with other kinds of seizures.

Eg> In 1705, an accurate description of absence seizure was made in a report to Académie Royale de Sciences
→

→ At the approach of the attack, the patient would sit down in a chair, with eyes open and would remain immobile and would not afterward remember falling into the state.

→ If the patient had begun to talk and the attack interrupted her, she took it up again at precisely the point at which she stopped & she believed she had talked continuously.

Characteristics of Absence Seizures :-

- a) It is characterized by short duration (5-10 secs)
 - b) An abrupt start and termination
 - c) An impairment of consciousness
 - d) High frequency throughout the day.
 - e) On the EEG, rhythmic spike and (SW) wave complexes are recorded in both hemispheres.
- The freq of SW complexes is 3Hz at the beginning of the discharges and may slow down to 2.5 - 2 Hz towards the end.

Epilepsy :- Epilepsy is a group of neurological diseases characterized by epileptic seizures.

Epileptic seizures are episodes that can vary from brief and nearly undetectable to long periods of vigorous shaking and can also result in physical injuries including occasionally broken bones.

There are several classes of epileptic seizures; however,

the most common type is the tonic-clonic seizure which consists of rhythmic muscle shocks of the entire body and is accompanied by loss of consciousness.



Hence point of interest is
'absence epilepsy.'