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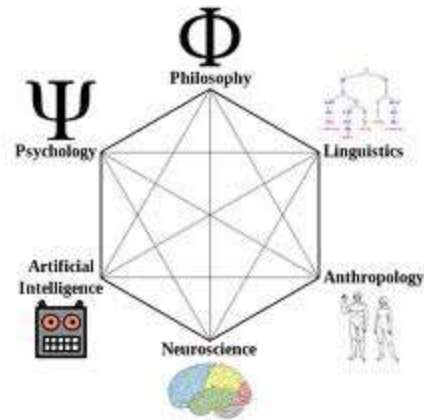
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Scientific m-Learning

4 - 7 June 2012

Cognitive Study of m-Learning Users in Developing Countries

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What is Cognition for Cognitive study?

- ▶ In science, **cognition**: refers to mental processes. These processes include attention, memory, producing and understanding language, solving problems, and making decisions (Ref: Wikipedia)



What is cognitive science?

- ▶ Cognitive science is the **science of mind and behavior**.
- ▶ Cognitive science is a scientific study of the mind with special emphasis on the use and acquisition of knowledge and information



Cognitive study is multi-disciplinary

▶ Perception

- ▶ acquiring real-time information about the surrounding environment.

▶ Language use

- ▶ making use of information about syntax, semantics and phonology.

▶ Reasoning

- ▶ combining different sources of information, deriving new information, testing consistency of information, etc.

▶ Action

- ▶ making use of information in action planning and guidance.

▶ Memory

- ▶ storing and retrieving information





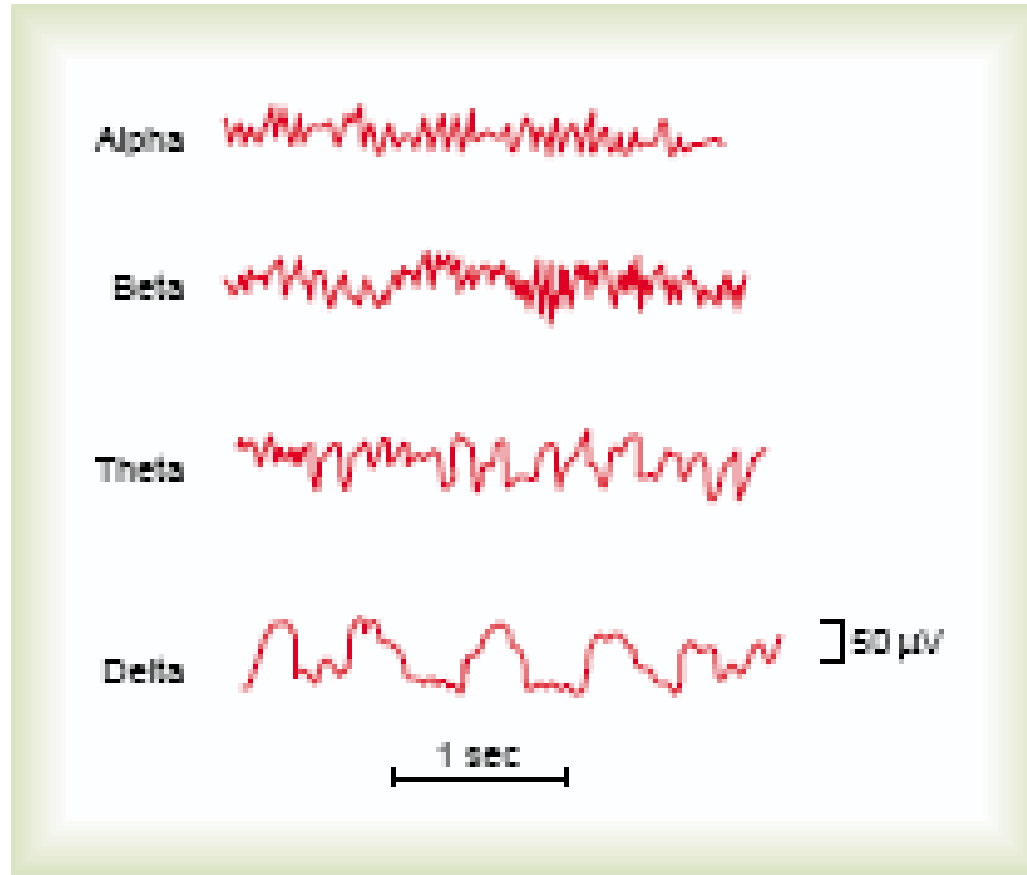
EEG Waves

- ▶ Alpha wave -- 8 – 13 Hz.
- ▶ Beta wave -- >13 Hz. (14 – 30 Hz.)
- ▶ Theta wave -- 4 – 7.5 Hz.
- ▶ Delta waves – 1 – 3.5 Hz.

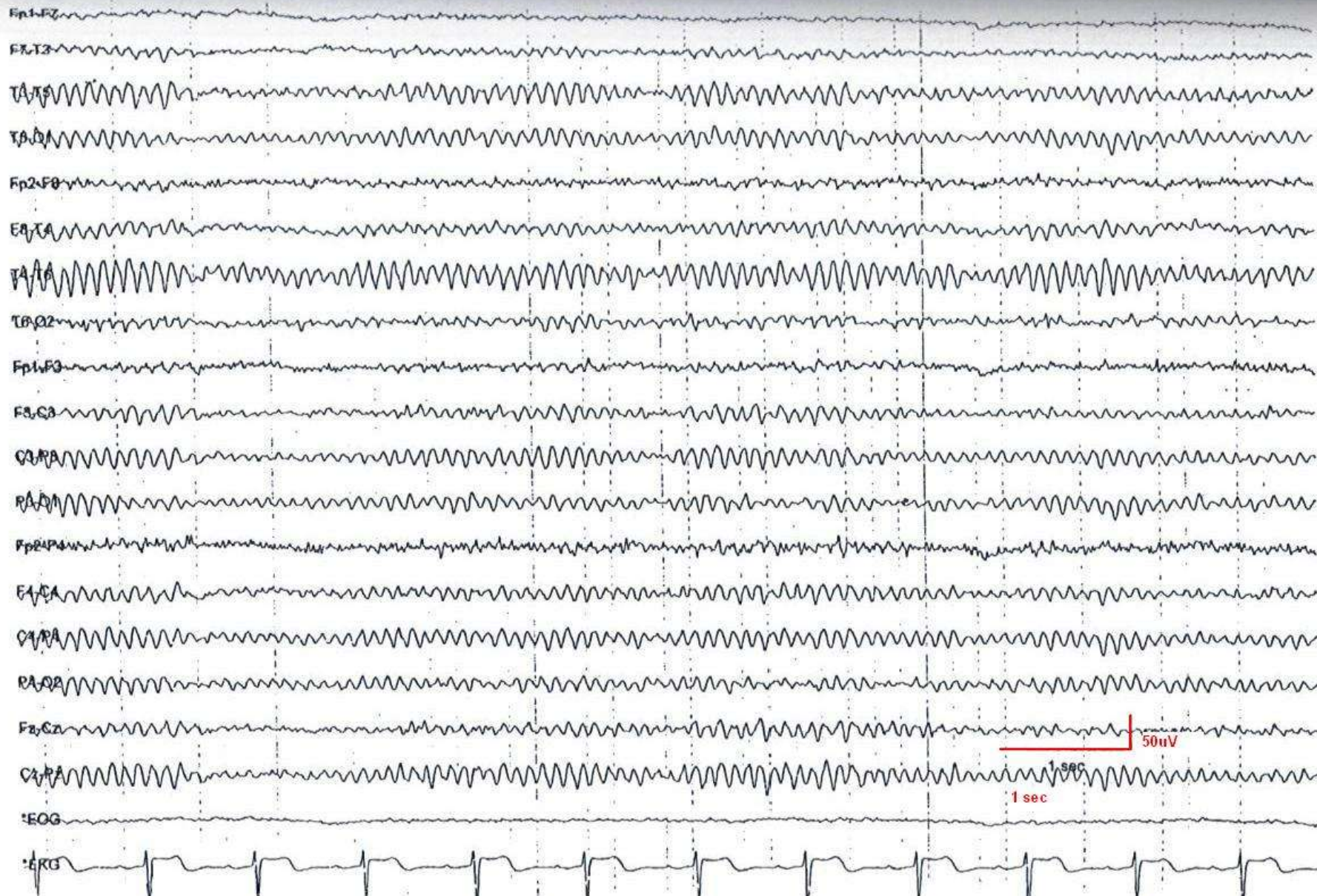
□ D T A B



Different types of brain waves in normal EEG



EEG Recording From Normal Adult Male



Alpha wave

- ▶ rhythmic, 8-13 Hz
- ▶ mostly on occipital lobe
- ▶ 20-200 μV
- ▶ normal,
- ▶ relaxed awake rhythm with eyes closed



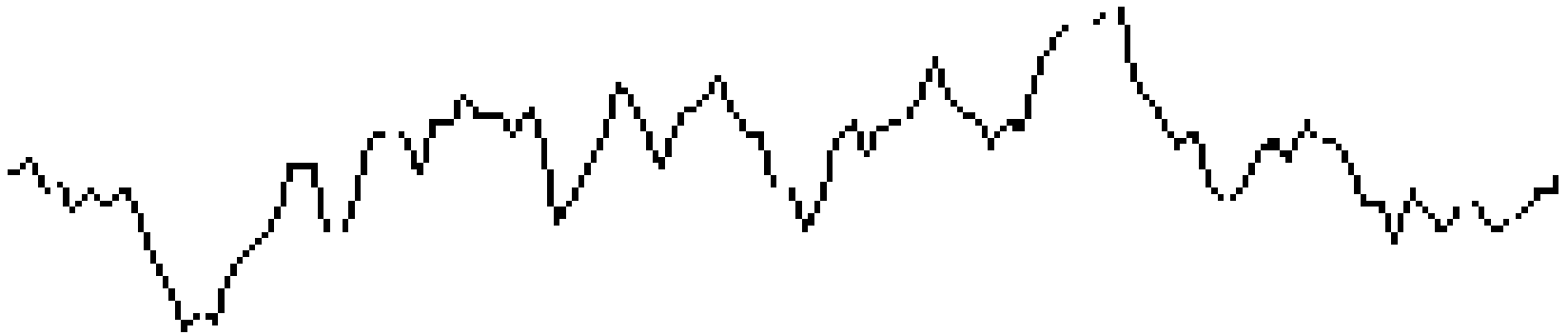
Beta wave

- ▶ irregular, 14-30 Hz
- ▶ mostly on temporal and frontal lobe
- ▶ mental activity
- ▶ excitement



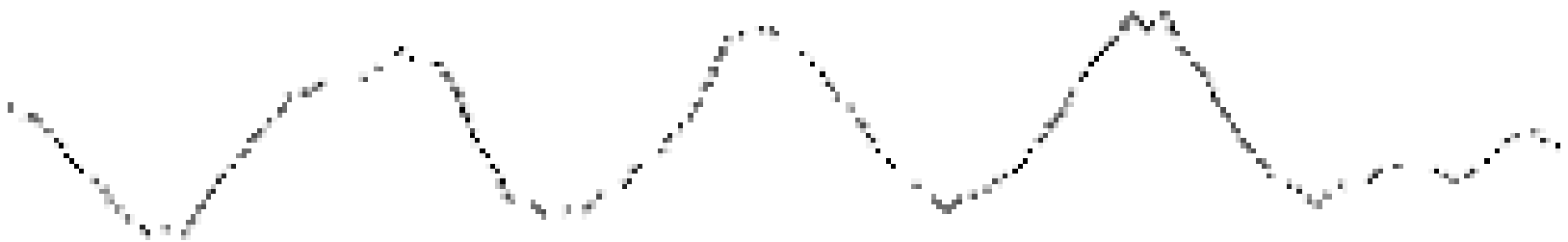
Theta wave

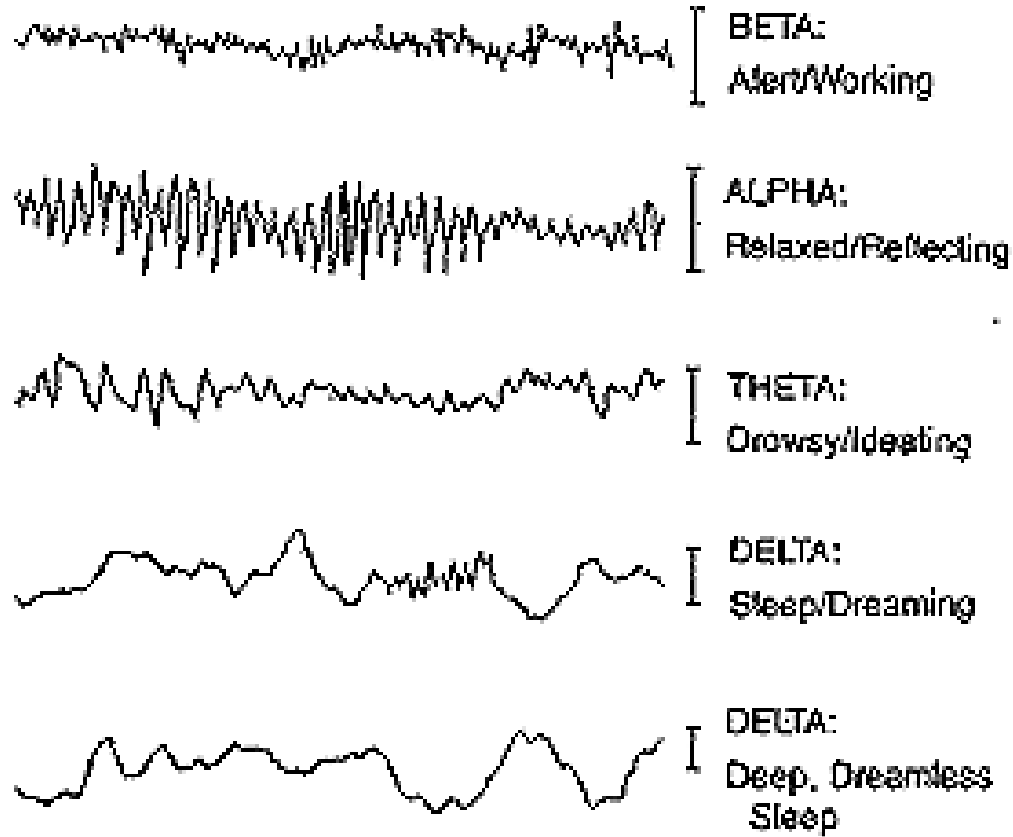
- ▶ rhythmic, 4-7 Hz
- ▶ Drowsy, sleep



Delta wave

- ▶ slow, < 3.5 Hz
- ▶ in adults
- ▶ normal sleep rhythm





Different types of brain waves in normal EEG

Rhythm	Frequency (Hz)	Amplitude (uV)	Recording & Location
Alpha(α)	8 - 13	50 - 100	Adults, rest, eyes closed. Occipital region
Beta(β)	14 - 30	20	Adult, mental activity Frontal region
Theta(θ)	5 - 7	Above 50	Children, drowsy adult, emotional distress Occipital
Delta(δ)	2 - 4	Above 50	Children in sleep

EEG Electrodes



Sliver Electrodes



Electrodes Cap

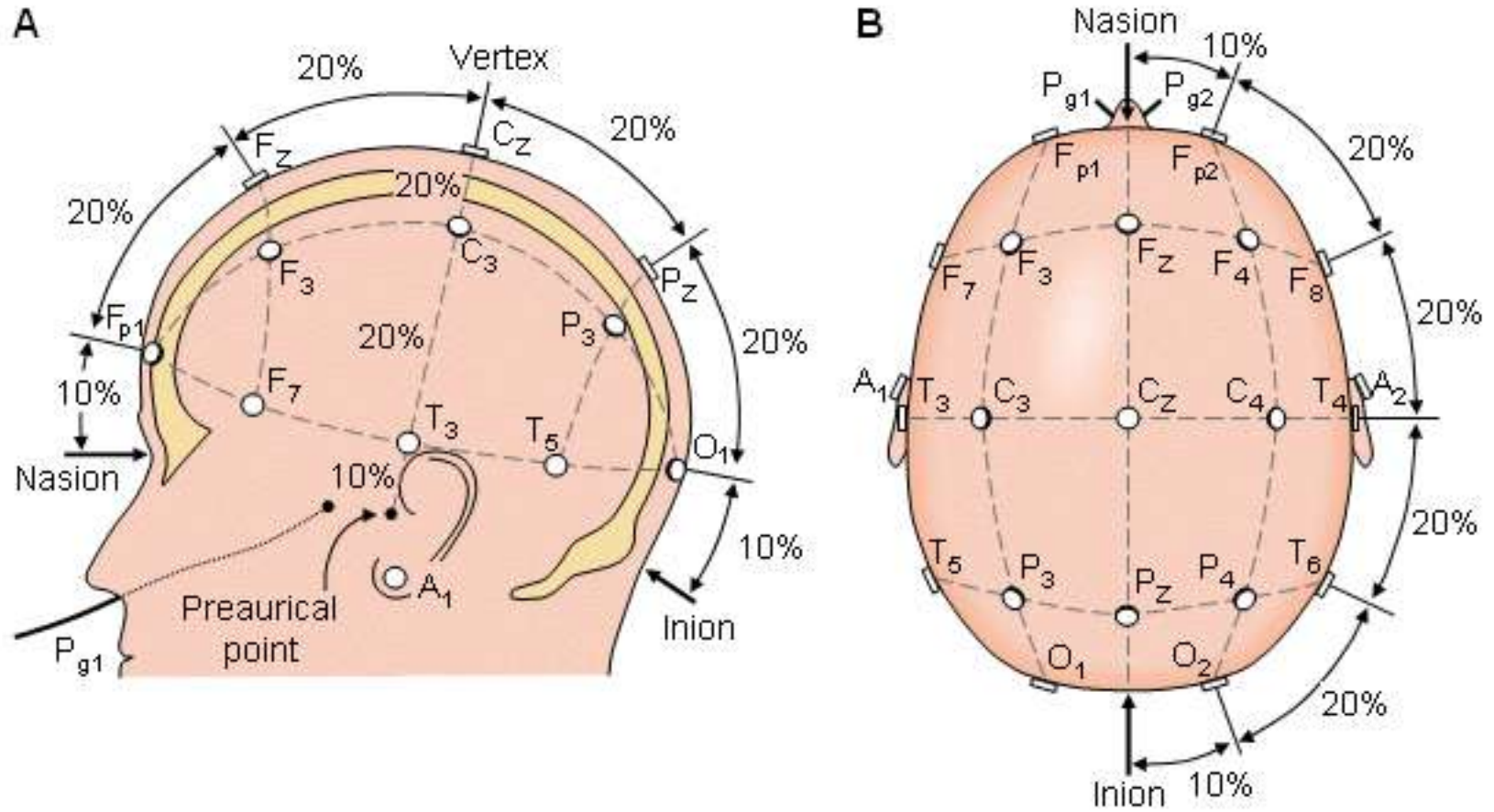


Procedure of EEG recording

- ▶ A standard EEG makes use of 21 electrodes linked in various ways (Montage).
- ▶ Ask the subject to lie down in bed.
- ▶ Apply electrode according to 10/20% system.
- ▶ Check the impedance of the electrodes.



10 / 20 % system of EEG electrode placement



EEG Electrodes

- ▶ Each electrode site is labeled with a letter and a number.
- ▶ The letter refers to the area of brain underlying the electrode

e.g. F - Frontal lobe and T - Temporal lobe.

- ▶ Even numbers denote the right side of the head and
- ▶ Odd numbers the left side of the head.

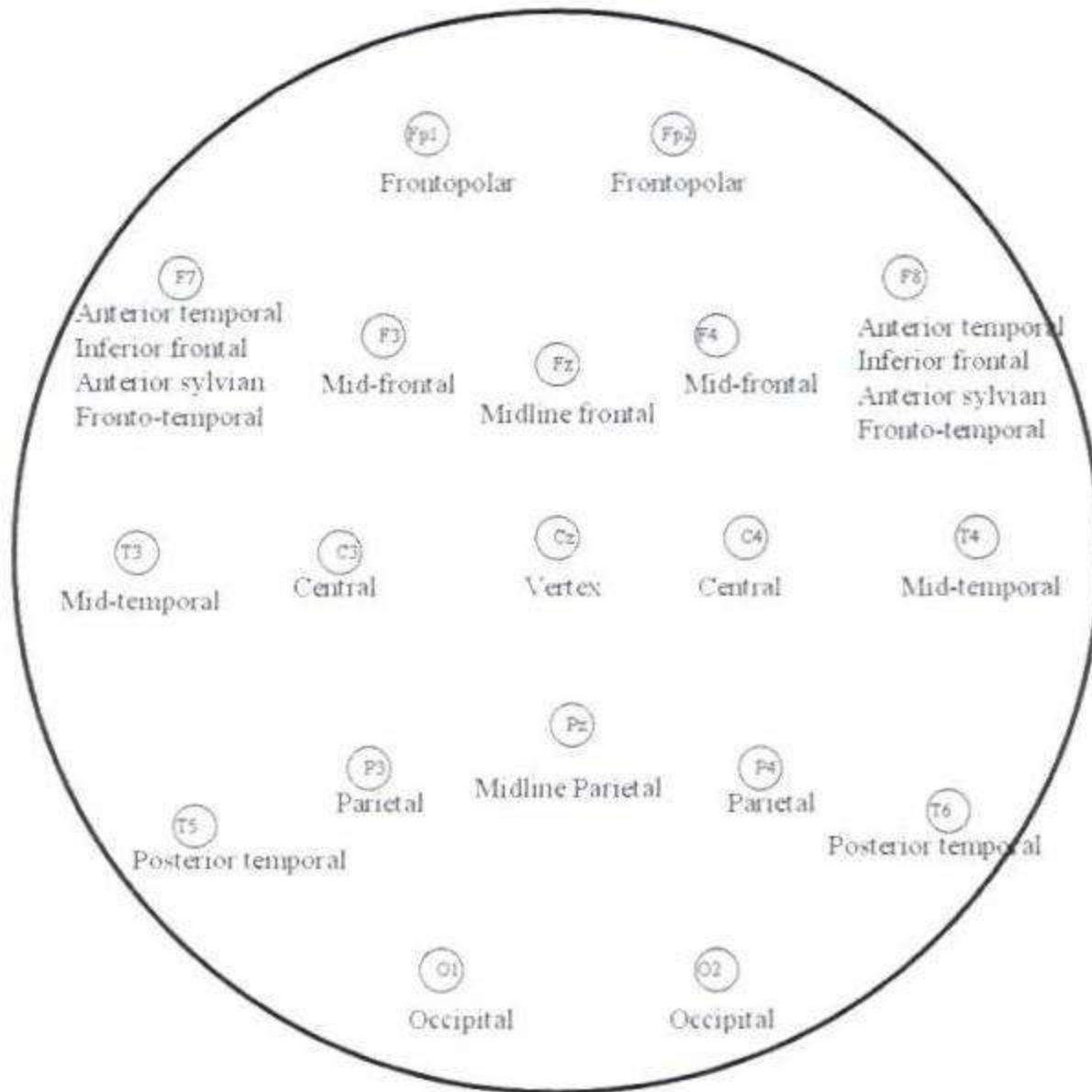


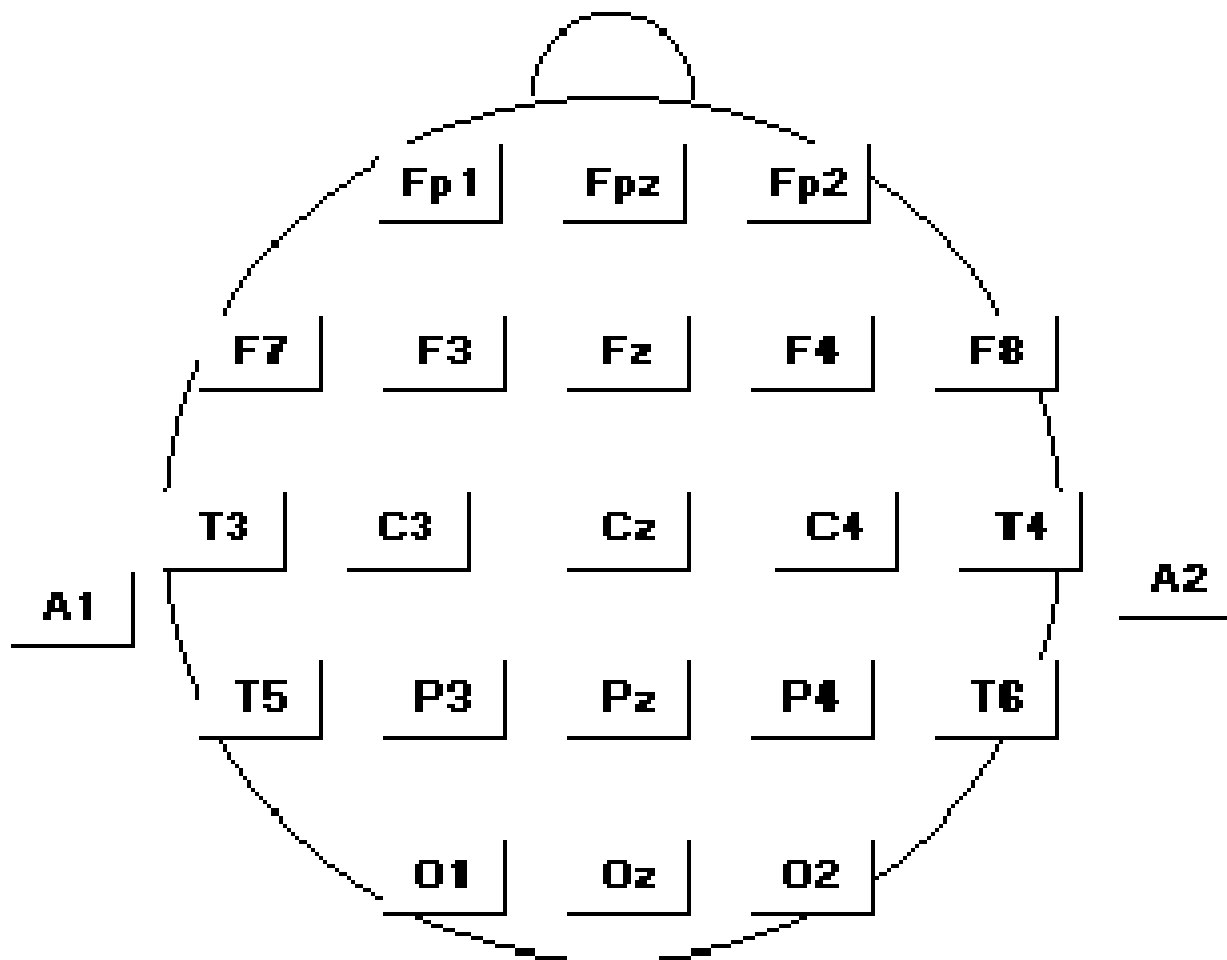
Two types of recording

- ▶ **Bipolar** – both the electrodes are at active site
 - ▶ Bipolar montage are parasagittal montage.
- ▶ **Unipolar** – one electrode is active and the other is indifferent kept at ear lobe.
 - ▶ Always watch for any abnormal muscle activity.
 - ▶ Ask the subject to open eyes for 10 sec. then ask them to close the eyes.



Full names for electrodes





Montage

- ▶ Different sets of electrode arrangement on the scalp by 10 – 20 system is known as montage.
- ▶ 21 electrodes are attached to give 8 or 16 channels recording.



Analysis

- ▶ Electrical activity from the brain consist of primarily of rhythms.
- ▶ They are named according to their frequencies (Hz) and amplitude in micro volt (μv).
- ▶ Different rhythms at different ages and different conditions (level of consciousness)
- ▶ Usually one dominant frequency (background rhythm)



Factor influencing EEG

- ▶ **Age**

- ▶ Infancy – theta, delta wave
- ▶ Child – alpha formation.
- ▶ Adult – all four waves.

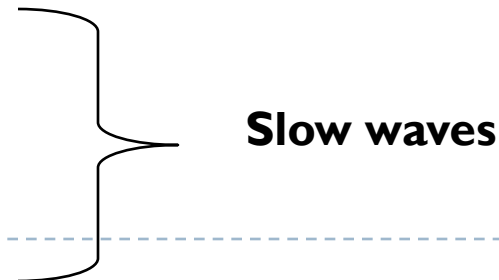
- ▶ **Level of consciousness (sleep)**

- ▶ **Hypocapnia(hyperventilation) slow & high amplitude waves.**

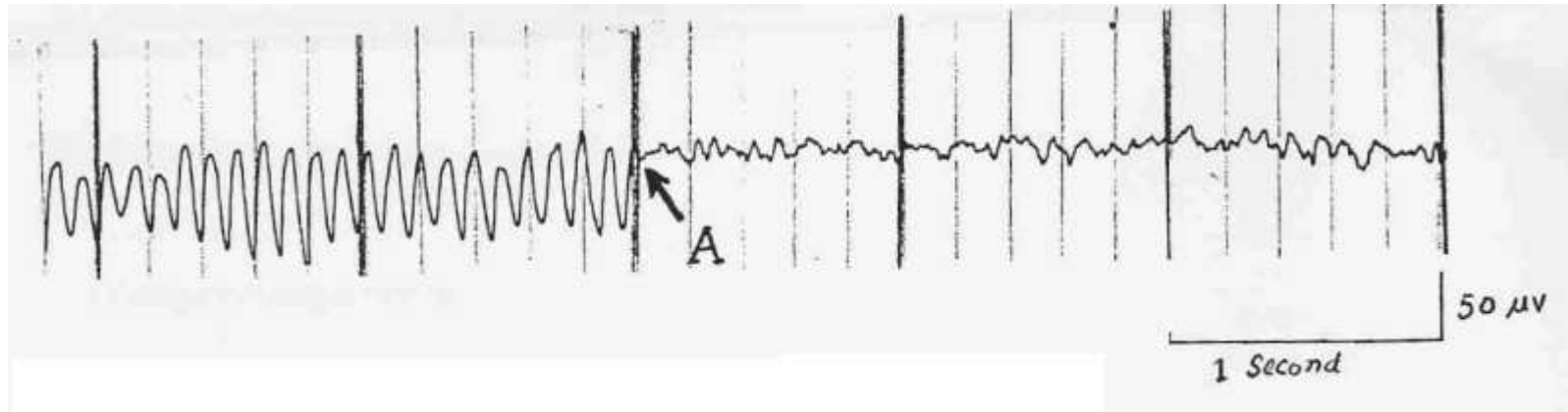
- ▶ **Hypoglycemia**

- ▶ **Hypothermia**

- ▶ **Low glucocorticoids**



Desynchronization or Alpha block



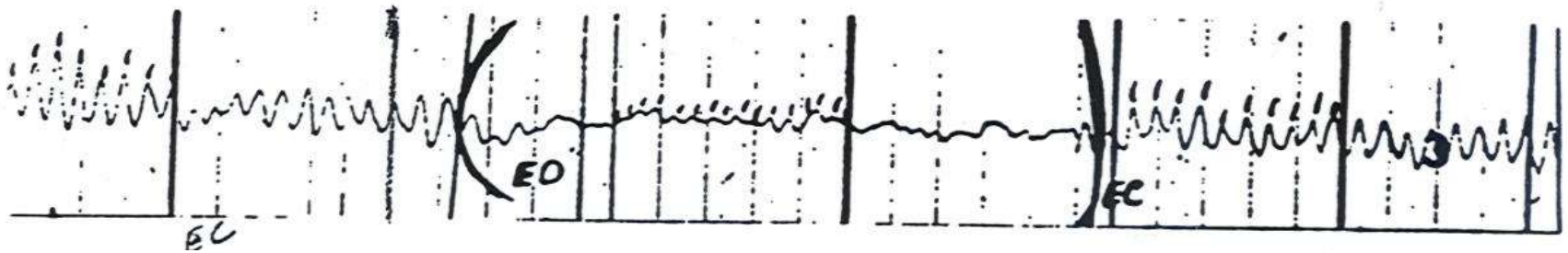
▶ **Cause:**

- ▶ Eyes opening (after closure)
- ▶ Thinking by the subject (mathematical calculation)
- ▶ Sound (clapping)



Eye opening

- ▶ Alpha rhythm changes to beta on eye opening (desynchronization / α -block)



EEG Artifacts

▶ Biological artifacts

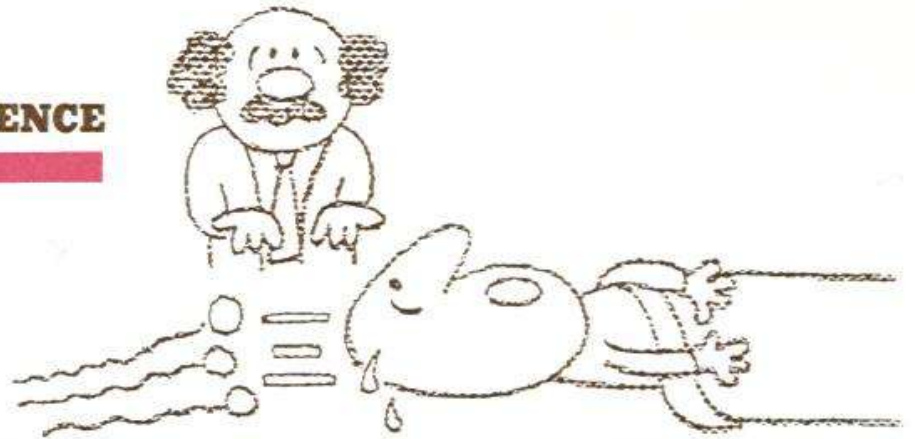
- ▶ Eye artifacts (including eyeball, ocular muscles and eyelid)
- ▶ ECG artifacts
- ▶ EMG artifacts
- ▶ Glossokinetic artifacts (minor tongue movements)

▶ External artifacts

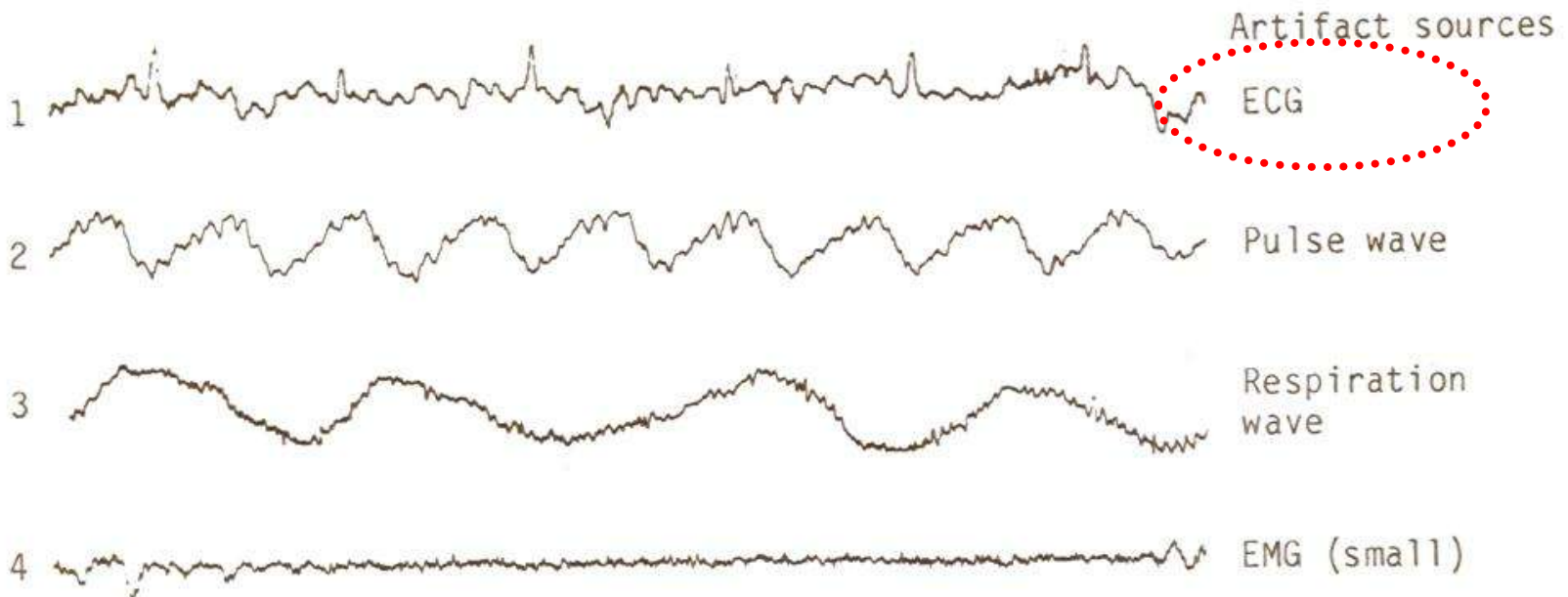
- ▶ Movement by the patient
 - ▶ settling of the electrodes
 - ▶ Poor grounding of the EEG electrodes
 - ▶ the presence of an IV drip
-

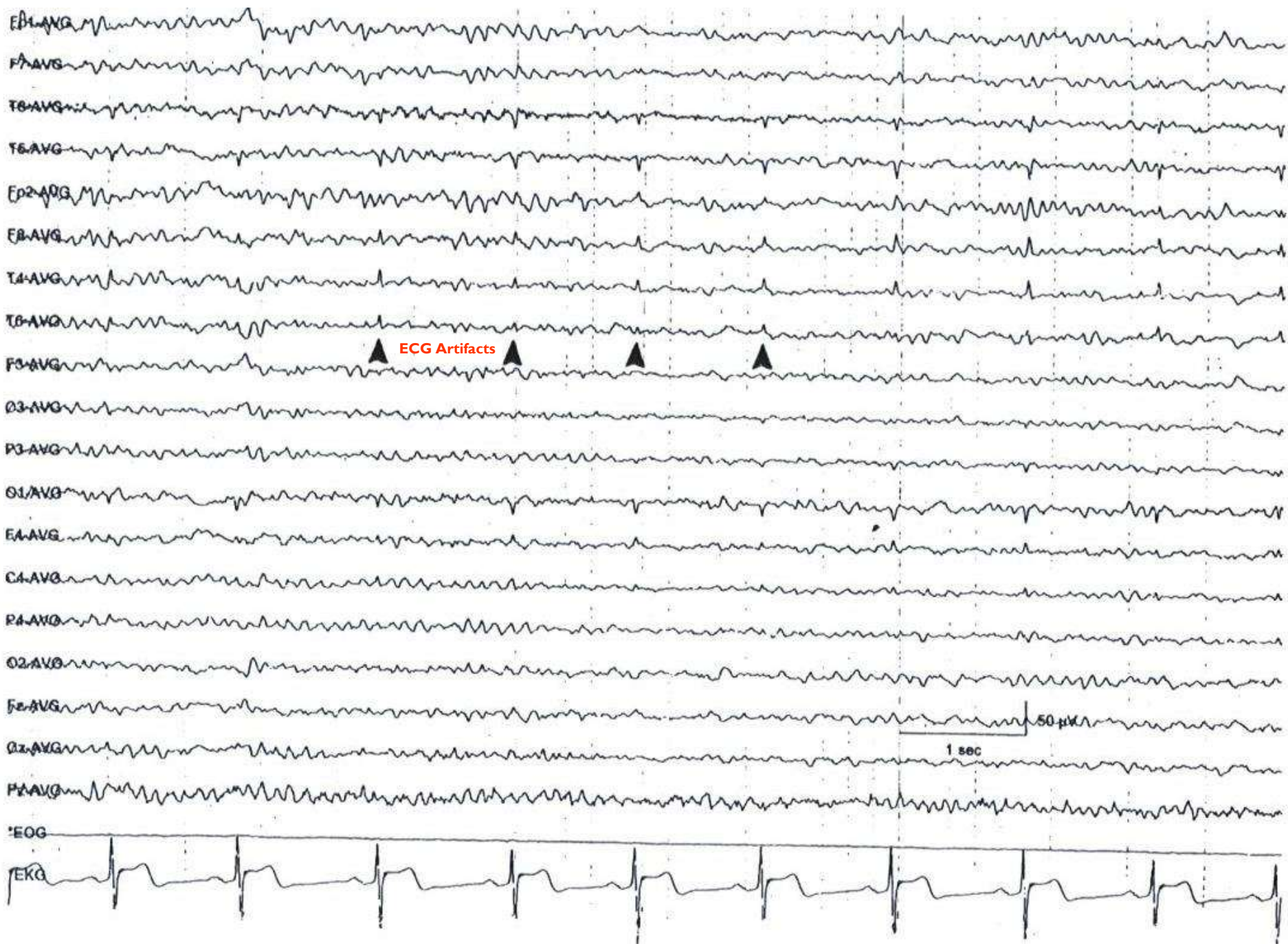


ARTIFACT AND NOISE INTERFERENCE



The following records are examples of artifact signals extraneous to the EEG equipment.





Now Let us see some interesting Demo



Demo using two different hardware

- ▶ 16 Channel EEG headset
- ▶ 2 channel EEG headset
- ▶ 16 Channel has expressive, cognitive and affective suits inbuilt
- ▶ 2 channel EEG headset is having Bluetooth connectivity



Demo using EEG headset to type text

- ▶ User can train himself and type any alphabet or numbers

