EXPERIMENT 5: ***Prestimulus Alpha-Band Power Biases Visual Discrimination Confidence but Not Accuracy, Samaha et al., 2017***

**Introduction**

* **Aim of the study:** The study aims to understand what is the ***passage from sensation to perception*** and what are the mechanisms that allow us ***to differentiate between a simple sensation to rather a perception of a stimulus.***
  + Differentiation between subjective experience of a stimulus vs objective accuracy.
* **Hypothesis:** the experiment was developed taking in mind the idea (discovered in 2016) that changes in criterion had been linked to changes in subjective awareness reports, therefore ***prestimulus alpha may impact confidence ratings*** in a discrimination task but ***should not affect discrimination accuracy.***
  + indeed, when cortical excitability is non-specifically increased, namely when there is a *low power in alpha bands*, neurons representing the presented stimulus as well as those representing the non-presented alternative should *both increase their firing rates by the same amount*, leaving discriminability between the two unaffected, but if ***confidence is driven primarily by evidence in favour of the decision rather than the balance of evidence for both possible choices***, then confidence will be systematically higher when cortical excitability is higher despite no change in accuracy
  + this practically means that our accuracy in the perception of a stimulus is not influenced by the prestimulus alpha band, indeed the *ratio between yes/no responses from our neurons remain unchanged*, what changes instead is the *absolute value of yes/no responses*, which gives us a ***greater confidence whenever there is a low power in the alpha band prior to the stimulus***
  + So, in one case you will be more confident, in the other case you will be less confident, despite not having change in accuracy.

**Objective**

* Differentiation between subjective experience of a stimulus vs objective accuracy.
* Study if changes in alpha power are related to changes in subjective confidence or in objective accuracy.

**Protocol**

* Recording of alpha activity with EEG technique
* We have a fixation point (first rectangle in foreground), then we have a target (in the second rectangle), then there is a blank rectangle and then a response. After this response, the subject were going to refer the level of confidence about the response (from 1 to 4)

**Method**

* in order to prove this theory, *ten participants* were subjected to a *two-choice orientation-discrimination task*, namely they were asked to say whether the stimulus they had been undergone was rotated left or right
* Two measures:
  + **accuracy**: because participants were asked to say whether the stimulus was rotated left or right
  + **confidence**: because participants were asked to rate the confidence of their response in a rate from 1 to 4.

**Results**

* results of a single trial regression of confidence and accuracy on power revealed that ***prestimulus low-frequency power prior to target onset was negatively correlated with confidence ratings, but not discrimination accuracy***
  + ***Accuracy in response cannot be accounted by the level of alpha power***, i.e alpha power is not able to differentiate good and bad responses
  + ***Confidence in response can be accounted by the level of alpha power in an inverse relation:*** every time the subject is ***more confident,*** is because the level of ***alpha is very low.***



* these findings show that ***oscillatory alpha power is responsible for subjective rather than objective measure of perception***, and also that it is possible to *dissociate confidence from accuracy solely on the basis of prestimulus brain states measurable with EEG*
* Proven that *alpha power* codes solely for the subjective experience of confidence during a perception discrimination task, one could ask what the neurophysiological correlate which accounts for perceptual accuracy is, that is ***which factor is related to a higher or lower probability of a correct detection*** (Look at experiment 6)

**Conclusion**

* **Alpha power** is responsible for **subjective** rather than objective measure of **perception**.
* It is possible to dissociate confidence from accuracy solely on the basis of prestimulus brain states measurable with EEG.
* what has been proven by *Samaha’s experiment* is that a *high alpha power* is related to a low cortical excitability (*active inhibitory state*) and a subsequent low confidence (*conservative response*) in discrimination tasks, while a *low alpha power* is related to a high cortical excitability and a subsequence high confidence (*liberal response*)