

**Background:**

Immediately before a self-paced voluntary movement the EEG from the motor and premotor cortices shows the Movement-related cortical potential (MRCP). This potential can be identified by back-averaging the EEG triggered at the start of electromyography (EMG) activity. The Bereitschaftspotential is a component of the MRCP that is a slowly rising negativity for about 1 to 2s prior to the EMG. The Contingent Negative Variation (CNV) is another event related potential (ERP). CNV is also a slow negativity prior to movements, but is triggered by imperative sensory stimuli in a reaction time task rather than self-generated. It occurs between a warning signal (S1) and a response signal (S2). With a CNV “when to do” is specified, but not necessarily “what to do”. The effects of go/no-go tasks on ERPs have been used for studying response inhibition processes. ERPs correlated with go/no-go tasks show major differences between go and no-go trials. They are considered to reflect response inhibition processes. Our aim is to identify EEG activity in a CNV paradigm related to freely choosing whether to move or not move compared to when being instructed to move or not move.

**Methods:**

In our study, simultaneous EMG-EEG recording will be done on 10 healthy volunteers. The subjects will be watching a screen that will give them a “prepare” stimulus (S1). This will be followed by a second stimulus (S2) giving them the order to execute the prepared plan. The S1 will be a command cue which will provide the subject with the instruction to go, no-go or to choose randomly between these two options. The S1-S2 interval will be used by the subject to prepare for moving or staying still at S2. The number of trials will be 200 (50 ‘go’, 50 ‘no go’, 100 ‘choose’). We will explore the frequency domain differences of the EEG on the 4 different conditions. The pattern of the events in each group will be described by the shape of the wave, latency of the peaks from S1, their distances from S2 and the beginning of muscle activity and amplitude of each peak.

**Discussion:**

This study will have multiple results. The first is the difference between go and no-go. Presumably this will be reflected in activity late in the S1-S2 interval as the motor program is finalized. The second, and the primary aim, will be reflected in the free choice compared with the instructed situation. Presumably, differences here will be reflected early in the S1-S2 interval when the decision will be made. A third result is whether the free choice potentials differ in go

versus no-go. Different frequency bands in the EEG represent different brain processes, and, in which frequency bands the important differences appear should illuminate the phenomena. Once the results of this experiment are known, a derivative experiment could be to deliver transcranial magnetic stimulation (TMS) at precise time and location to influence what might be subjectively considered free choice.