# DOES THE SELF-REGULATION OF SLOW CORTICAL POTENTIALS AUTOMATE?

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The Thought Translation Device is based on the self-regulation of slow cortical potentials (SCP), i.e. changes in cortical polarization that last from 300 ms to several seconds. Patients are required to produce voluntary SCP shifts of either positive or negative amplitude, thereby moving a cursor on a notebook screen to select letters, words or symbols from a computer menu. For communication, it is very important that patients obtain a high percentage of correct potential shifts, because errors decelerate communication exponentially. Until now, it has been unclear if SCP self-regulation represents a skill that can automate. It was demonstrated, however, that SCP self-regulation improves over time and remains stable even without feedback training. In this study, we investigated whether SCP self-regulation automates with training and could thus be considered as a skill. In accordance with the neurophysiological literature it was hypothesized that at the beginning of SCP-training widespread cortical areas are activated. If SCP self-regulation automates with increasing practice, cortical activation was expected to become more focal under the feedback electrode at Cz (neurophysiological indicator of automaticity). At the same time performance was assumed to become more stable (less variability across training sessions) and less erroneous (increasing percentage of correct responses) (behavioral indicators of automaticity). The participant was a male patient first diagnosed with amyotrophic lateral sclerosis at the age of 38. EEG was recorded from Fz, Cz and Pz referenced to both mastoids. Data are reported from a total of 179 runs (a run comprising 70 single trials) at the beginning of feedback training. Successful cursor control was revealed in the voltage difference between positive and negative SCP shifts measured in μV. The magnitude of the voltage difference was considered as an indicator for the learning of SCP self-regulation. Our hypothesis implied that with increasing automaticity the voltage difference would increase at Cz and decrease at both Fz and Pz. At the same time, the performance measured as percent correct responses should improve, and the variability measured as standard deviation in 10 consecutive runs should decrease. Results indicated that the voltage difference increased at Cz as a function of runs. Thus the patient learned to move the cursor up and down according to the task requirements. The voltage difference at Fz and Pz, decreased, i.e. with increasing practice the patient's cortical activity became topographically more focal underneath the recording electrode. This is confirmed by the fact that the correlation between cortical activation at Fz and Cz was negative and no correlation was found between the activation at Cz and Pz. At the same time, the percentage of correct responses correlated with the increase of the voltage difference at Cz and with the decrease at Fz. The patient's performance became more and more stable with increasing practice. For him the criteria for automaticity were met. He learnt SCP self-regulation very well and reached 100% correct responses. SCP self-regulation may not be performed without any attentional resources, because it must comply with the trial rhythm. However, as demonstrated in this study, SCP self-regulation automates with increasing practice and requires less attentional resources that can be employed for aspects of communication.