

Do nature documentaries affect event-related desynchronization (ERD) induced by motor imagery neurofeedback?

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Introduction: Motor imagery (MI) in combination with neurofeedback (NF) has gained interest in several research areas, including motor neurorehabilitation. It is well known that MI practice affects performance and motor learning. Yet, how the context in which MI-NF training takes place affects event-related desynchronization (ERD) as a commonly used NF modality is scarcely explored. Daeglau and colleagues postulated that the contextual factor of declarative interference following MI-NF has a negative effect on the development of ERD [1]. However, no change in ERD within the mu and beta (8-30 Hz) frequency range was observed across sessions in either the experimental or control conditions. This study investigated whether these unexpected results could be attributed to the use of nature documentaries as a pause and control task. Therefore, in an additional control condition, nature documentaries were replaced by quiet rest. ERD results were compared with the no-interference control group of [1].

Material, Methods, and Results: 64-channel EEG data were recorded from 17 healthy subjects (8 females, 18-35 years, M and SD: 25.2 ± 4.2 years) who completed three sessions of kinesthetic MI-NF of a simple finger-tapping task (FTT) on two consecutive days (*group quiet rest*). Results were compared to the no-interference group (17 participants, 10 females, 23-32 years, M and SD: 25.8 ± 2.5 years) of [1] (*group documentaries*). Descriptively, no increase in MI NF ERD was observed over sessions (Figure 1). This was confirmed with a mixed repeated measures ANOVA. Neither session ($F_{(2,64)} = 1.831$, $p = .169$, $\eta^2 = .01$) nor group ($F_{(1,32)} = .055$, $p = 0.815$, $\eta^2 = .001$) showed a significant main effect. A significant interaction effect (session*group) was present ($F_{(2,64)} = 3.526$, $p = .035$, $\eta^2 = .019$) but subsequent paired t-tests showed no significant difference in conditions ($p_{\text{bon-holm}} \geq .144$).

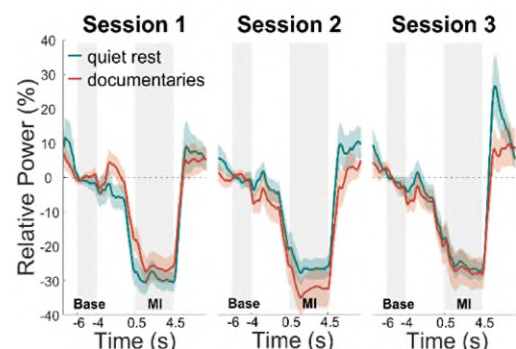


Figure 1: Time courses of MI NF ERD of group quiet rest (blue) and documentaries (red).

Discussion: If nature documentaries prevent or reduce across-session ERD gain, this should have become apparent in the comparison of data sets. However, ERD was highly comparable between groups. Similarly structured MI-NF studies have demonstrated an increase in ERD over multiple sessions [2, 3]. Whereas the contralateral ERD did not change across sessions in Zich and colleagues, the ipsilateral ERD did decrease, indicating an ipsilateral learning effect, which was not examined in the present study [2]. Ono and colleagues have shown that different types of NF led to enhanced ERD, while realistic congruent NF is more effective than 2D object-based NF (similar to ball steering used as NF condition here) [3]. Additionally, the simplicity of the FTT should be considered, as more complex practice structures can have a beneficial effect on MI [4].

Significance: MI with NF is a promising approach in neurorehabilitation, although a non-negligible number of users do not exhibit adequate NF performance. Contextual factors might contribute to this. Here, resting and watching a nature documentary had similar effects on the MI-NF induced ERD, indicating no general contextual influences from the documentary. However, contextual factors might further exacerbate interindividual differences [4]. Future research should continue exploring the effect of context factors relevant for observing an ERD gain across MI-NF sessions and the functional significance of its presence/absence.

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References:

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