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## **Detecting subjective rhythmic attending in ERP**

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### **Background**

In the so-called clock illusion, isochronous stimulus trains are subjectively converted into a binary grouped percept (tick-tock-tick-tock instead of tick-tick-tick-tick). This effect has been shown to occur spontaneously and is measurable in omitted evoked potentials in EEG (eg. Brochard, Abecasis, Potter, Ragot, & Drake, 2003)

### **Aims**

To use the manifestation of subjective accenting in EEG for realisation of a Brain-Computer Interface, we measured EEG while subjects imagined different groupings superimposed on an isochronous train of stimuli, thus producing accented and nonaccented beats in a train of perceptually identical metronome ticks. By eventually classifying the accented from the non accented beats in EEG, a communication method for patients with neurodegenerative diseases or central neural damage preventing motor activity, the so-called locked-in syndrome, can be created.

### **Method**

In 15 right-handed female students subjective accenting was induced by presenting a rhythmic pattern and asking them to continue it mentally, keeping movement minimal. To ensure correct continuation and attention, an omission detection task concluded every trial. The experiment consisted of 80 trials. Both a binary a ternary metric pattern were used. The EEG-data, recorded with electrodes placed according to the 10-20 system, were analysed using cluster randomization. This method utilises stricter statistical criteria and is an appropriate way to prevent the need to correct for multiple comparisons in EEG data.

### **Results**

We investigated perception (the beginning of a trial) and imagery (the latter part) in both ERP and frequency domains. For perception, results were comparable over participants and showed different EEG signatures for strong and weak beats. In the frequency domain no significant results were found. For imagery, 64% of participants showed highly significant within-subjects results, but these cancelled each other out in a grand average. In the frequency domain, increased  $\theta$ -activity was seen for accented beats. No other frequency results were significant.

### **Conclusions**

It appears interpersonal variability prevents us from seeing general effects of imagined accents, although a strong consistency was seen in a good proportion of participants. Roughly, two types of responses were seen, most likely to be produced by different cognitive strategies in task performance. The frequency results indicate a possible coupling of rhythmic accenting with motor imagery. These data support the feasibility of using subjective accenting to drive a BCI-device. Brochard, R., Abecasis, D., Potter, D., Ragot, R., & Drake, C. (2003). The "ticktock" of our internal clock: Direct brain evidence of subjective accents in isochronous sequences. *Psychological Science*, 14(4), 362-366.

*Key words: Subjective rhythmization, Dynamic attending*

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