

# The Influence of Familiarity on Beat Perception and Oscillatory Entrainment



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## Background

### Introduction

- Humans spontaneously synchronize to the beat in acoustic rhythms.<sup>1</sup>
- The beat can entrain neural oscillations, as measured by EEG power enhancement at beat-related frequencies.<sup>2</sup>
- Power enhancement may reflect internal beat-related processes.<sup>3</sup>
- However, as we are regularly exposed to strong-beat rhythms in music, neural responses may be influenced by familiarity with beat rhythms.
- Thus EEG power enhancements may reflect *familiarity* with strong-beat patterns, rather than a beat-related process.

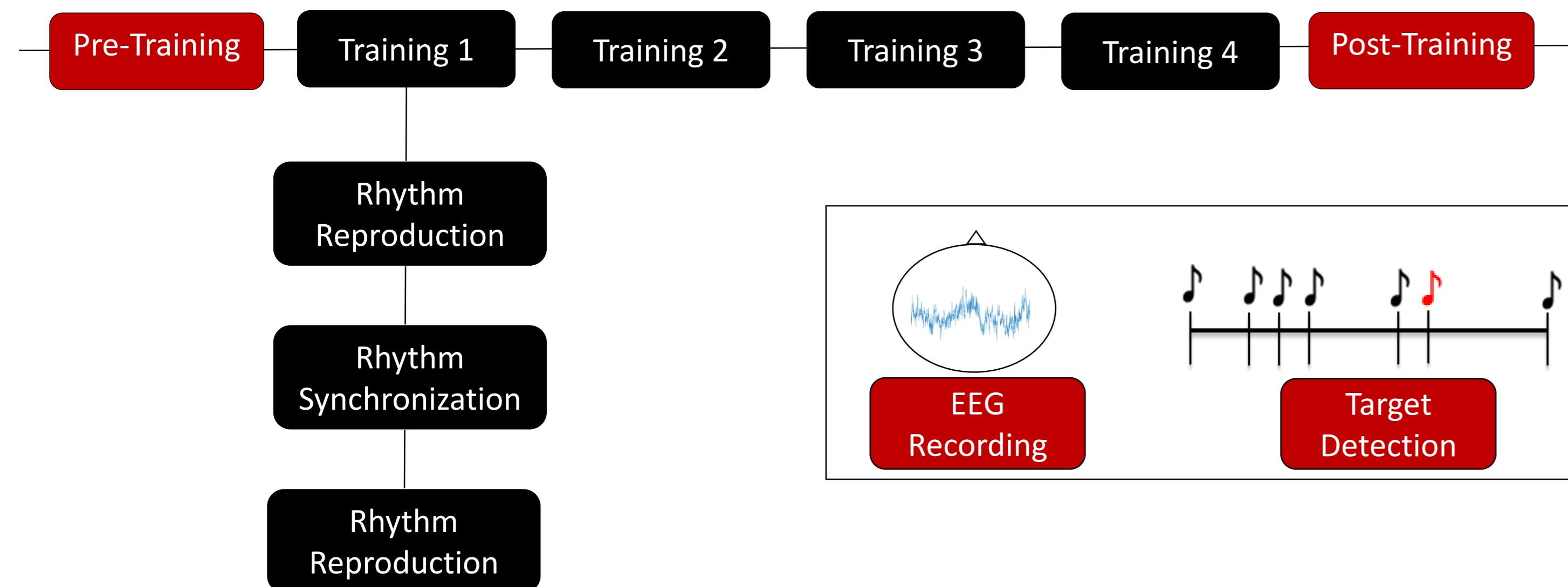
### Hypothesis

- Familiar rhythms will elicit increased EEG power at beat-related frequencies, regardless of beat strength.

## Method

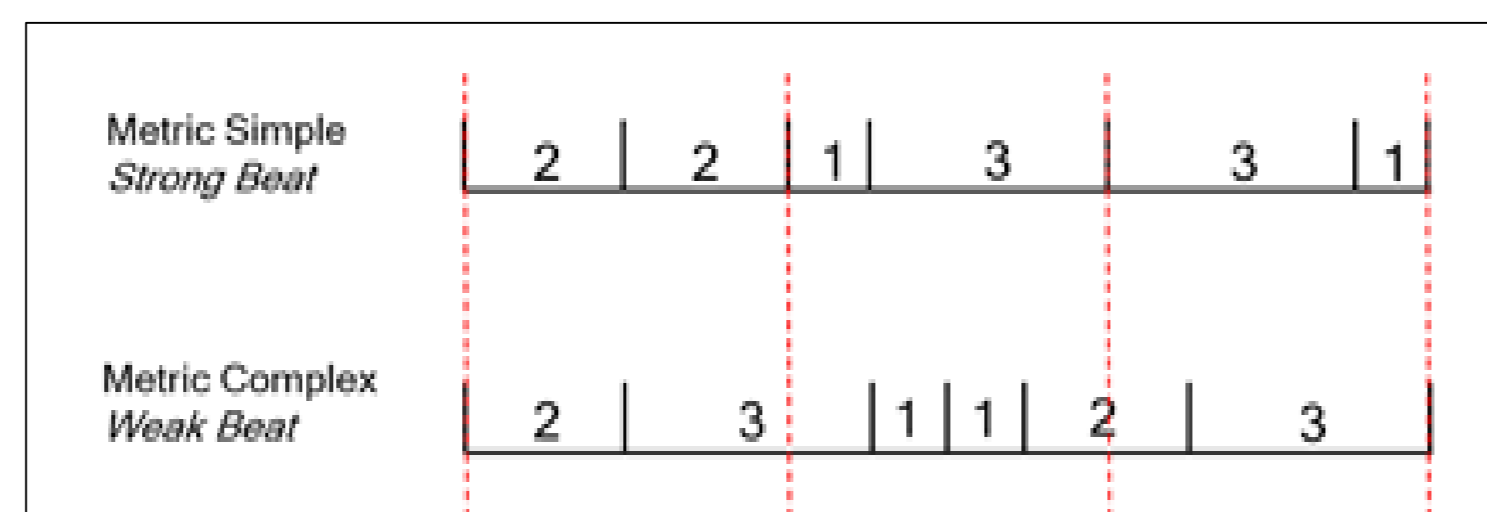
### Stimuli

- 16 filled-tone rhythms, 8 strong-beat, 8 weak-beat.
- Initially all novel: half the rhythms trained over 4 days to become familiar.

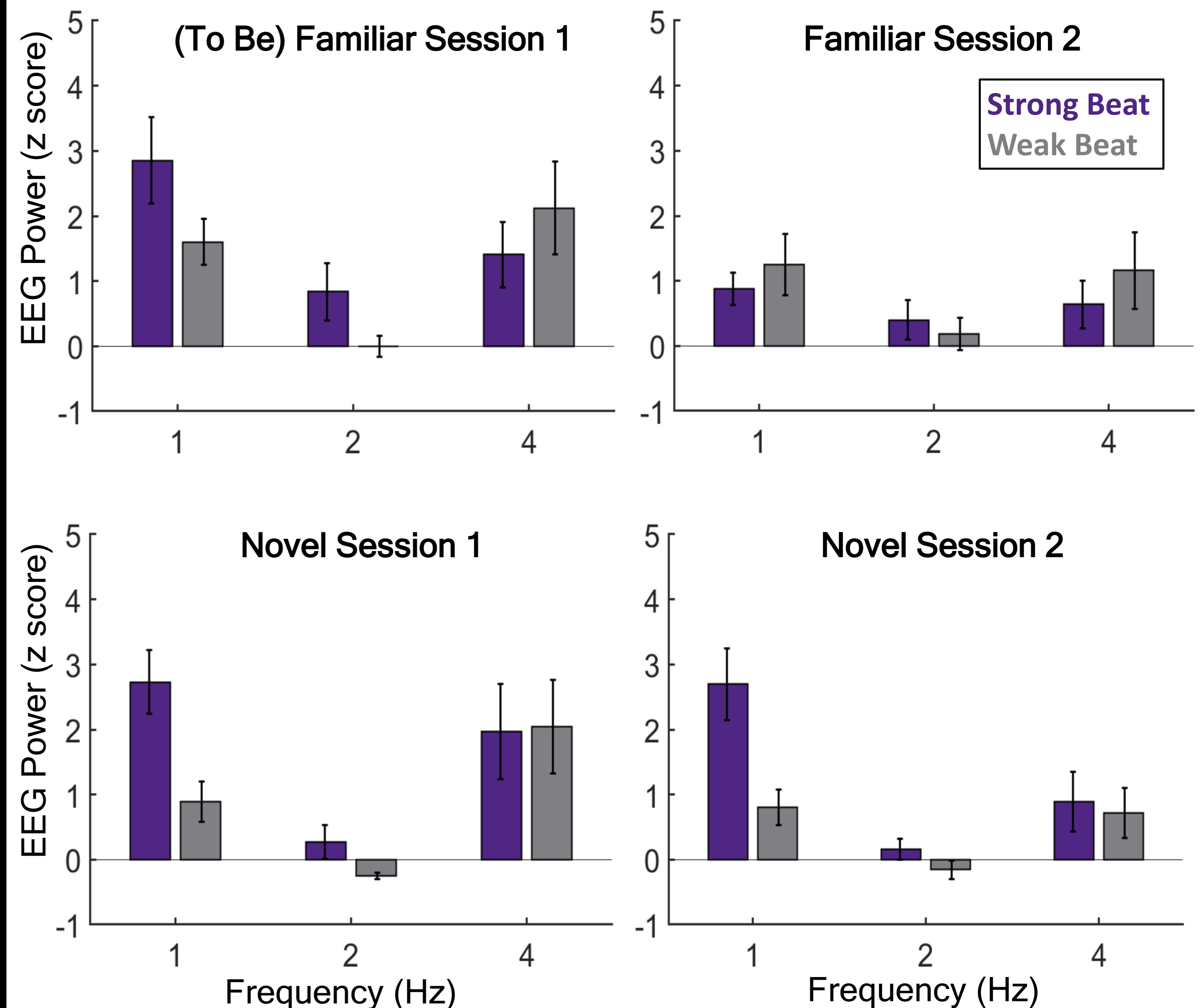


### Procedure

- Session 1: all rhythms novel
- Session 2: ½ novel, ½ trained
- 64 Channel BioSemi EEG, N=11



## Power at the Beat Frequency is Altered by Familiarity



## Discussion

### Findings

- Familiar strong-beat rhythms elicit lower EEG power than novel rhythms.
- Familiar weak-beat rhythms elicit similar EEG power as novel rhythms.
- Novel rhythms elicit similar EEG spectra across sessions, suggesting the power reduction is not generalized to novel rhythms.

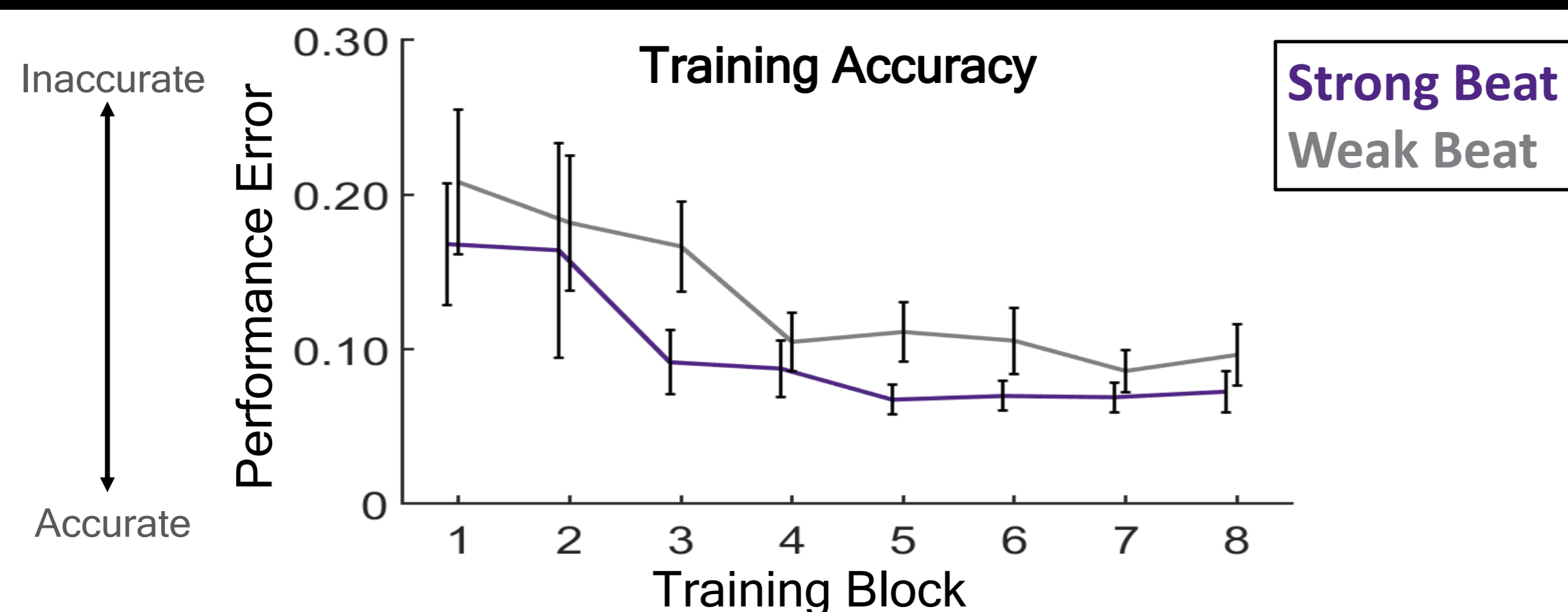
### What does it mean?

- Oscillatory entrainment to beat frequencies altered by stimulus familiarity.
- Familiarity decreases, rather than increases, EEG power/entrainment to acoustic rhythms at beat-related frequencies.
- Familiarity therefore does not explain oscillatory entrainment to the beat.

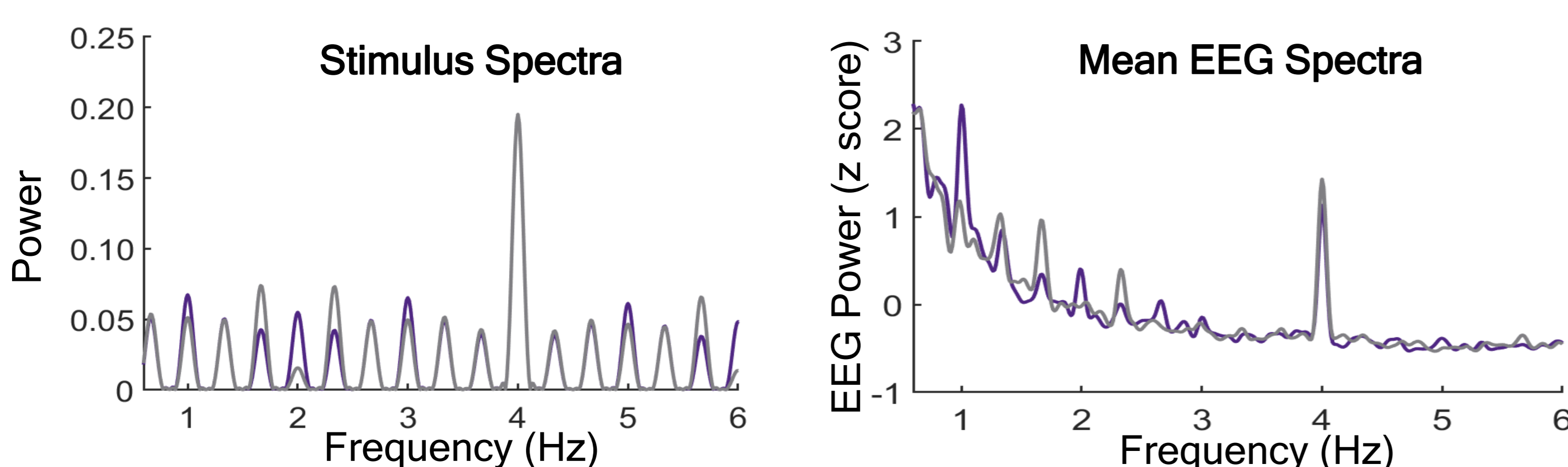
### What *might* it mean?

- Oscillatory entrainment may reflect a beat processing function (e.g. internal representation or beat finding).
- Familiarity-related reduction in beat-frequency power may be caused by processing efficiency, and/or decreased attention.

## Training Improves Timing Accuracy



## EEG Reflects Stimulus Spectra and Beat Strength



## References

- <sup>1</sup>Grahn, J. A., & Brett, M. (2007). Rhythm and beat perception in motor areas of the brain. *Journal of Cognitive Neuroscience*, 19(5), 893-906.
- <sup>2</sup>Nozaradan, S., Peretz, I., Missal, M., & Mouraux, A. (2011). Tagging the neuronal entrainment to beat and meter. *Journal of Neuroscience*, 31(28), 10234-10240.
- <sup>3</sup>Fujioka, T., Trainor, L. J., Large, E. W., & Ross, B. (2011). Internalized timing of isochronous sounds is represented in neuromagnetic beta oscillations. *Journal of Neuroscience*, 32(5), 1791-802.

## Acknowledgements

