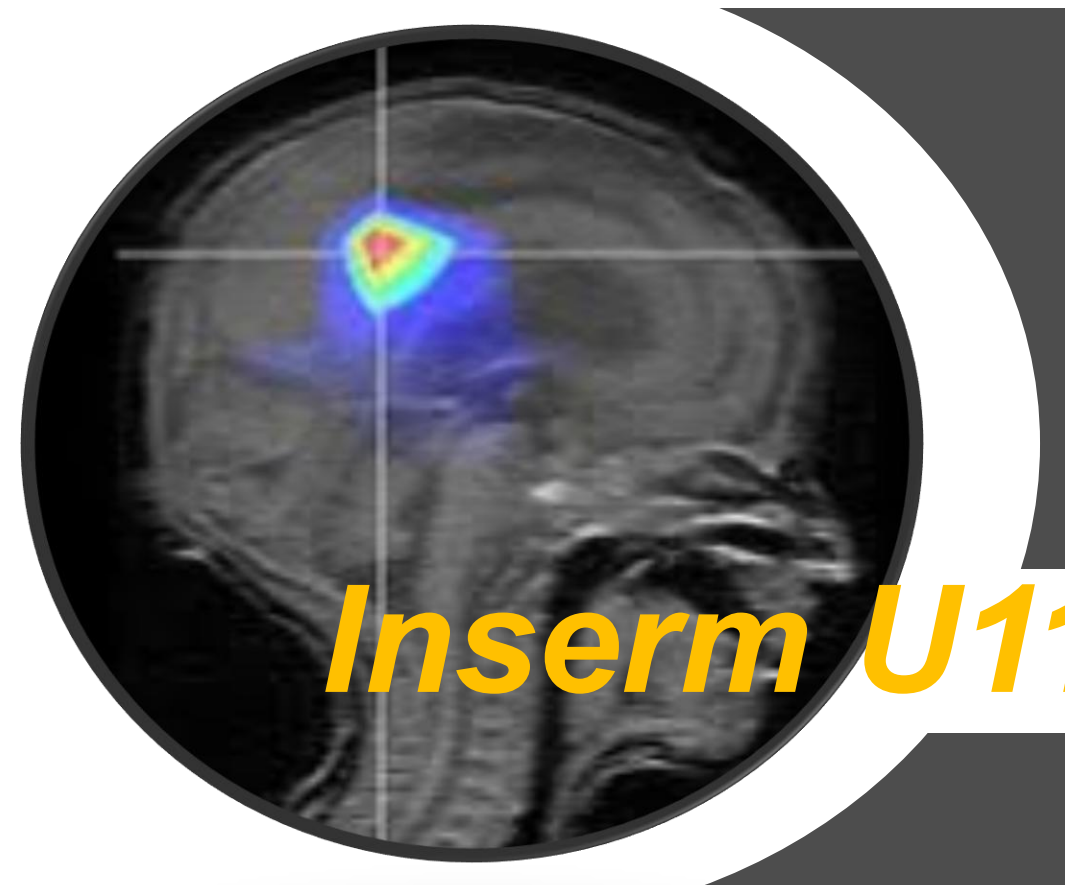




The influence of tempo on neural encoding of rhythmic hierarchy in neonates

Inserm U1105

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Introduction

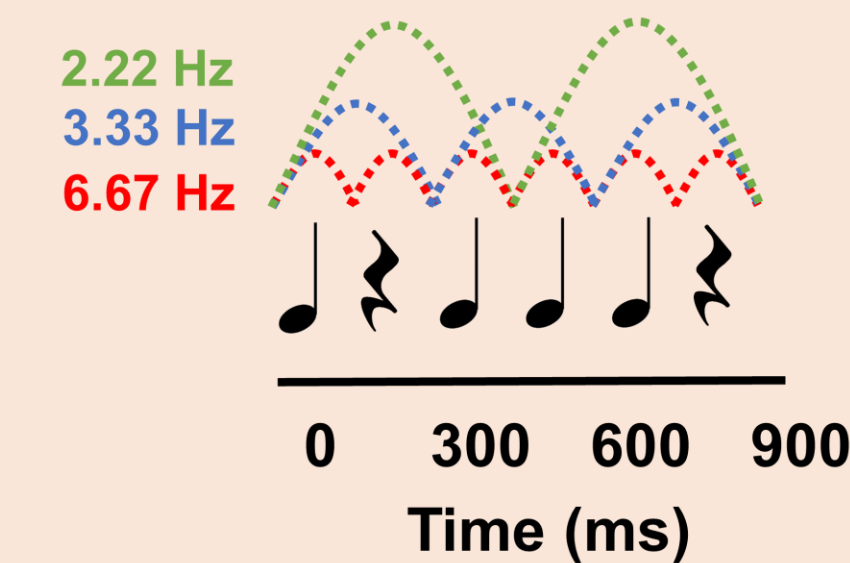
- In the previous studies on premature newborns (28–37 weeks of gestational age), we found that neural synchronization to auditory rhythm develops progressively during the third trimester. Specifically, synchronization to the beat and to metrical structures (beat groupings) emerged gradually, with meter-related synchronization appearing closer to term. Moreover, synchronization to the duple meter was stronger than to the triple meter^{1,2}.
- These findings raised this question: What is the impact of tempo on neural synchronization of the developing brain to rhythmic hierarchies?

2

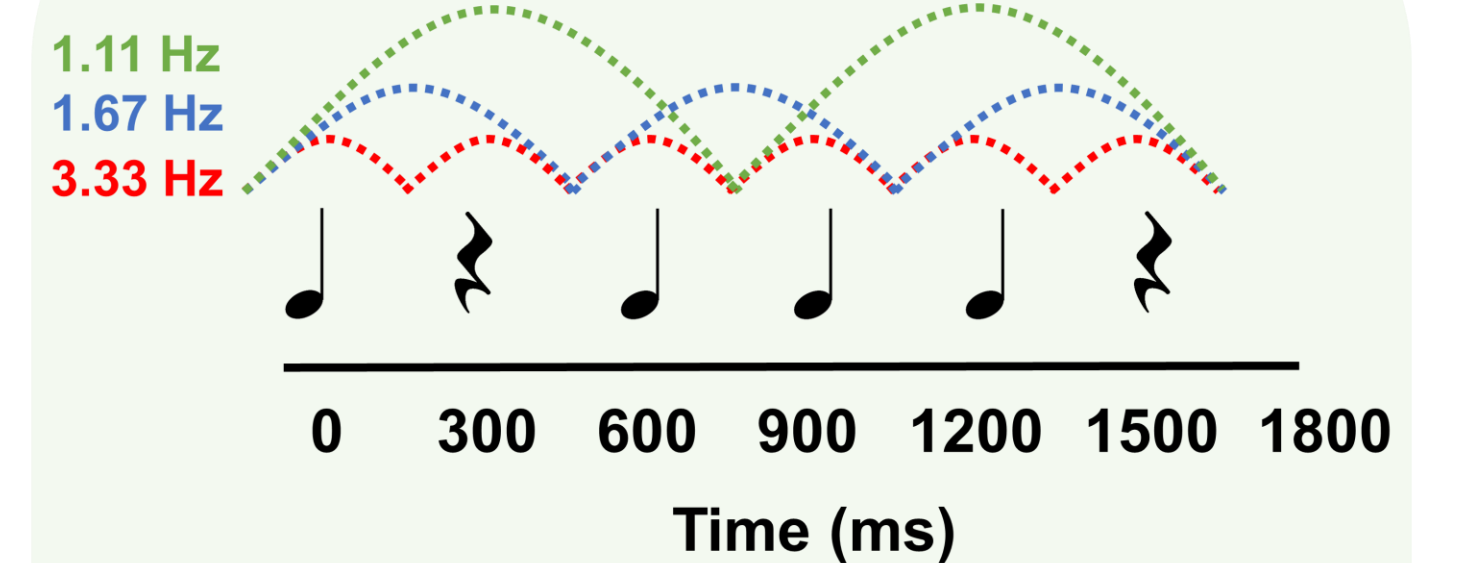
Material & Method

- A. Fast tempo stimulus. B. Slow tempo stimulus.
- C. & D. Frequency analysis showing beat, duple, and triple frequency content of the stimuli.
- We tested 23 full-term newborns (mean 38.32 ± 4.66 wGA) and 19 adults (mean 21.63 ± 3.51 years old).
- The duty cycle of tones is 50% to have the same energy at each rhythmic hierarchy between fast and slow tempi.
- To address the synchronization between EEG signal and rhythmic hierarchies, we used the brain-stimulus synchronization index. In this method, we calculated the coupling strength of the phase difference between the narrow-band filtered EEG signal and the simulated sinusoidal signal at the target frequency.

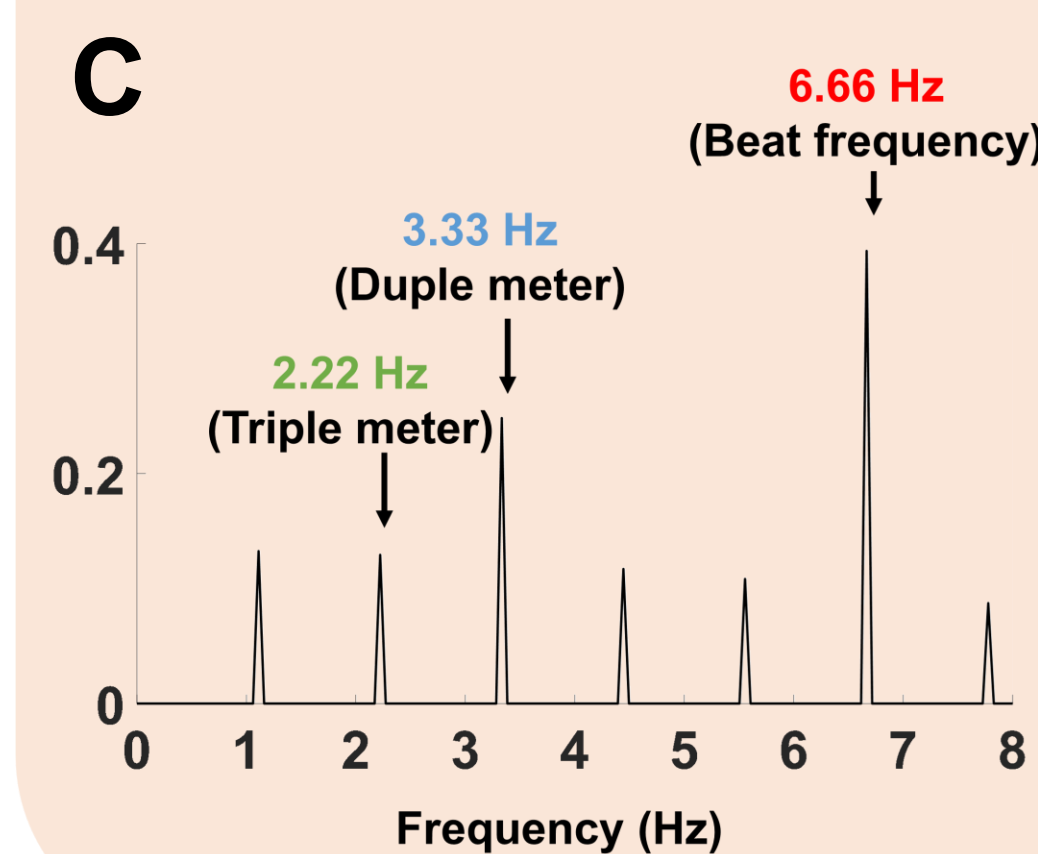
A Fast tempo



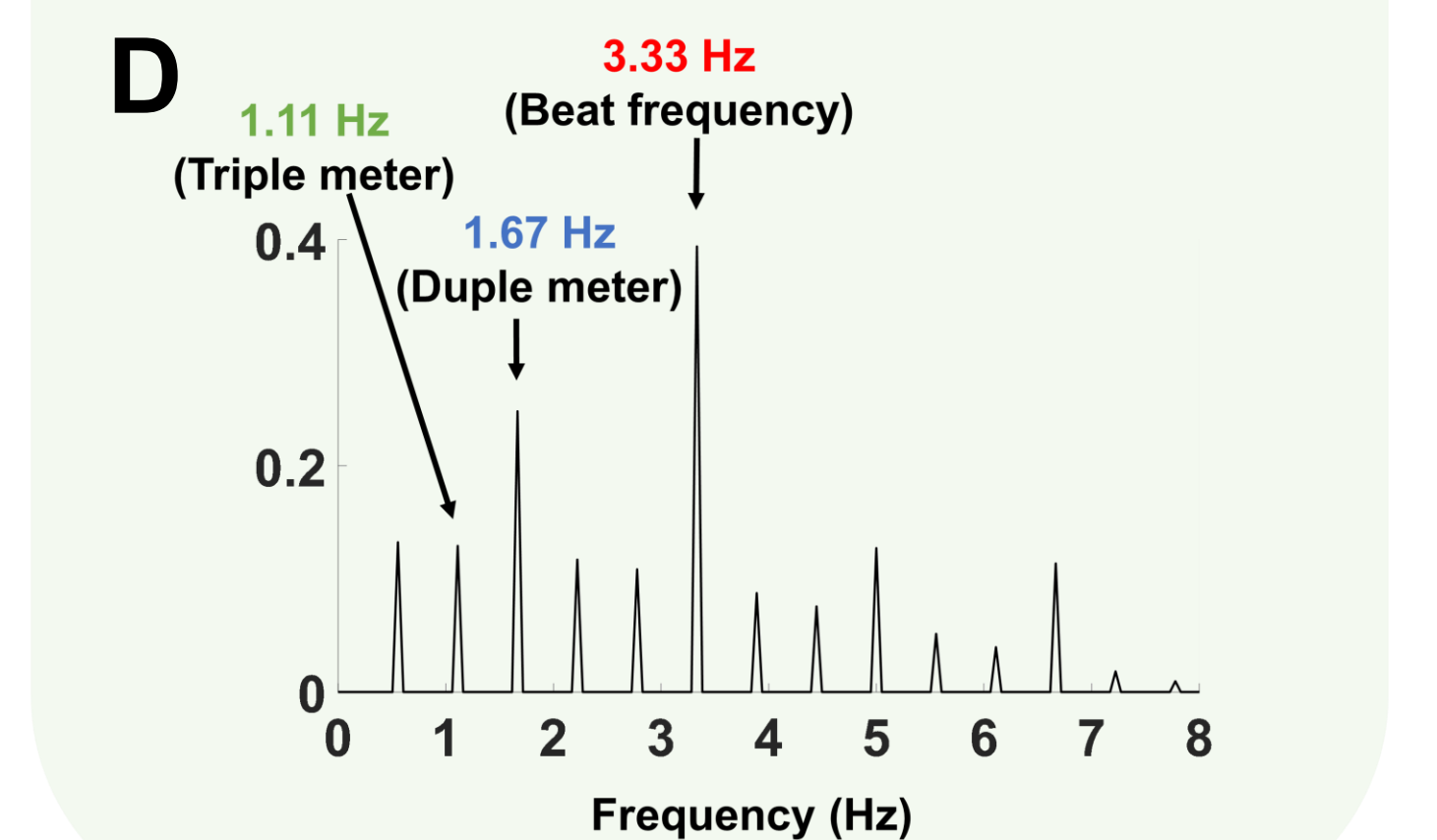
B Slow tempo



C



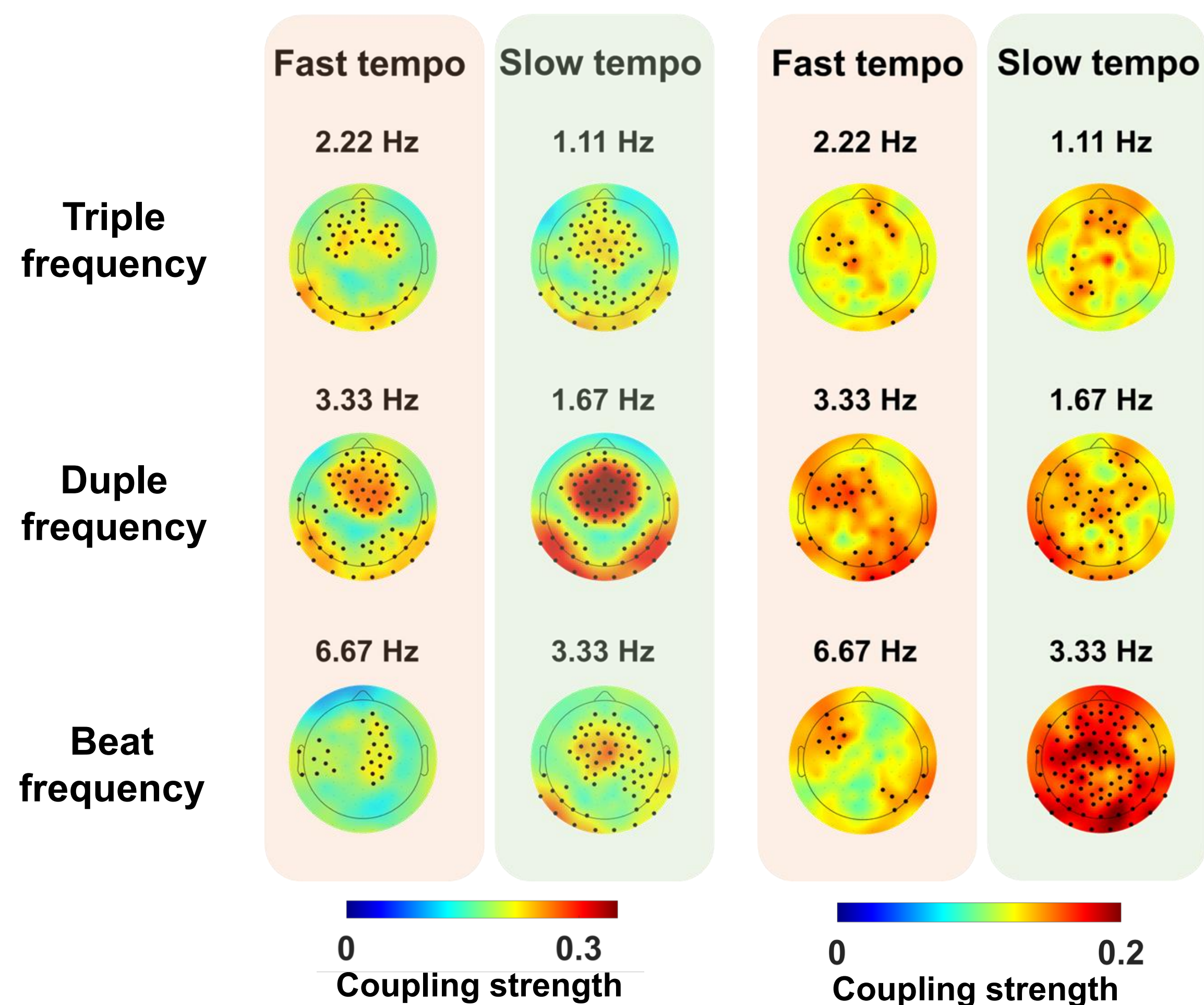
D



3

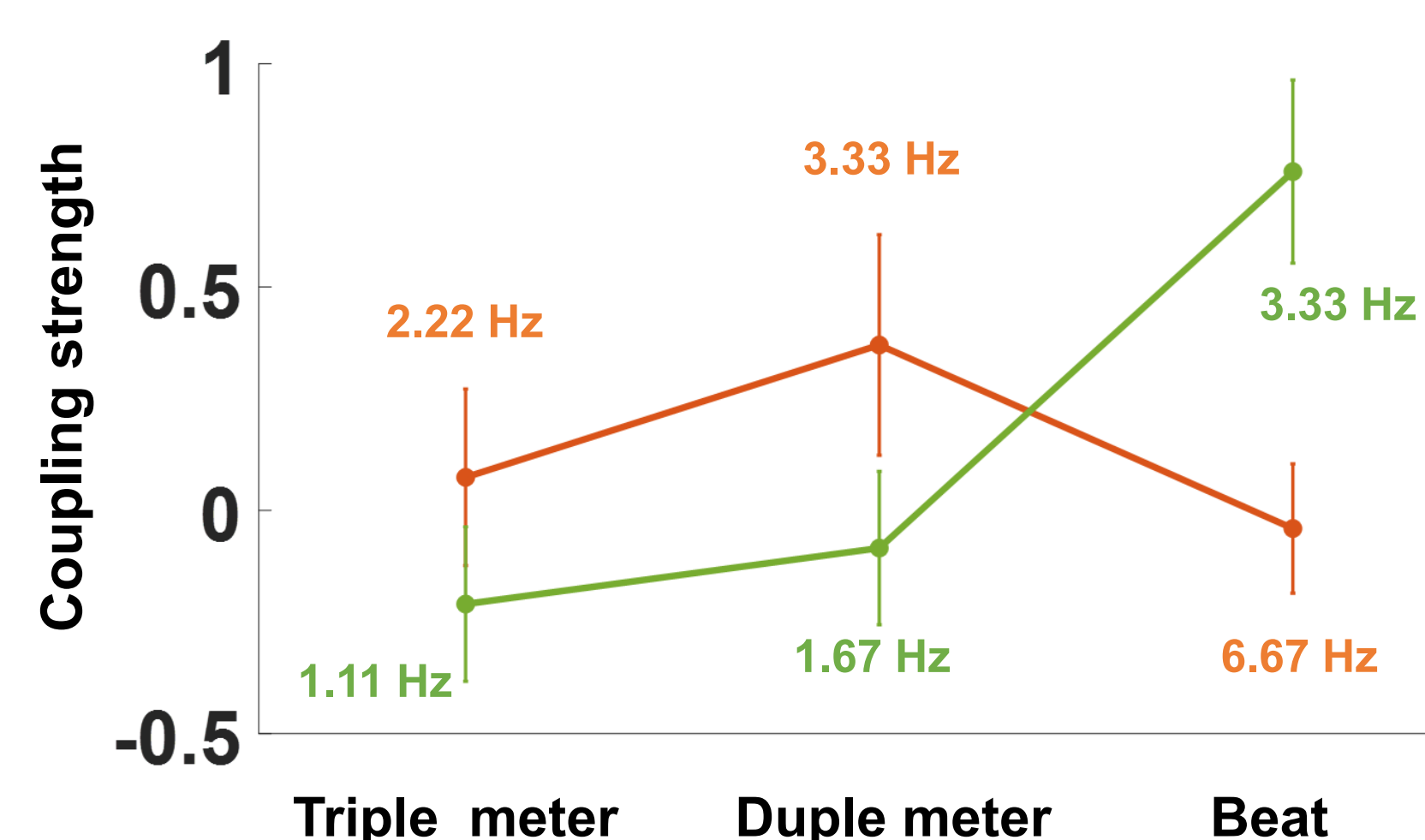
Results

Adults



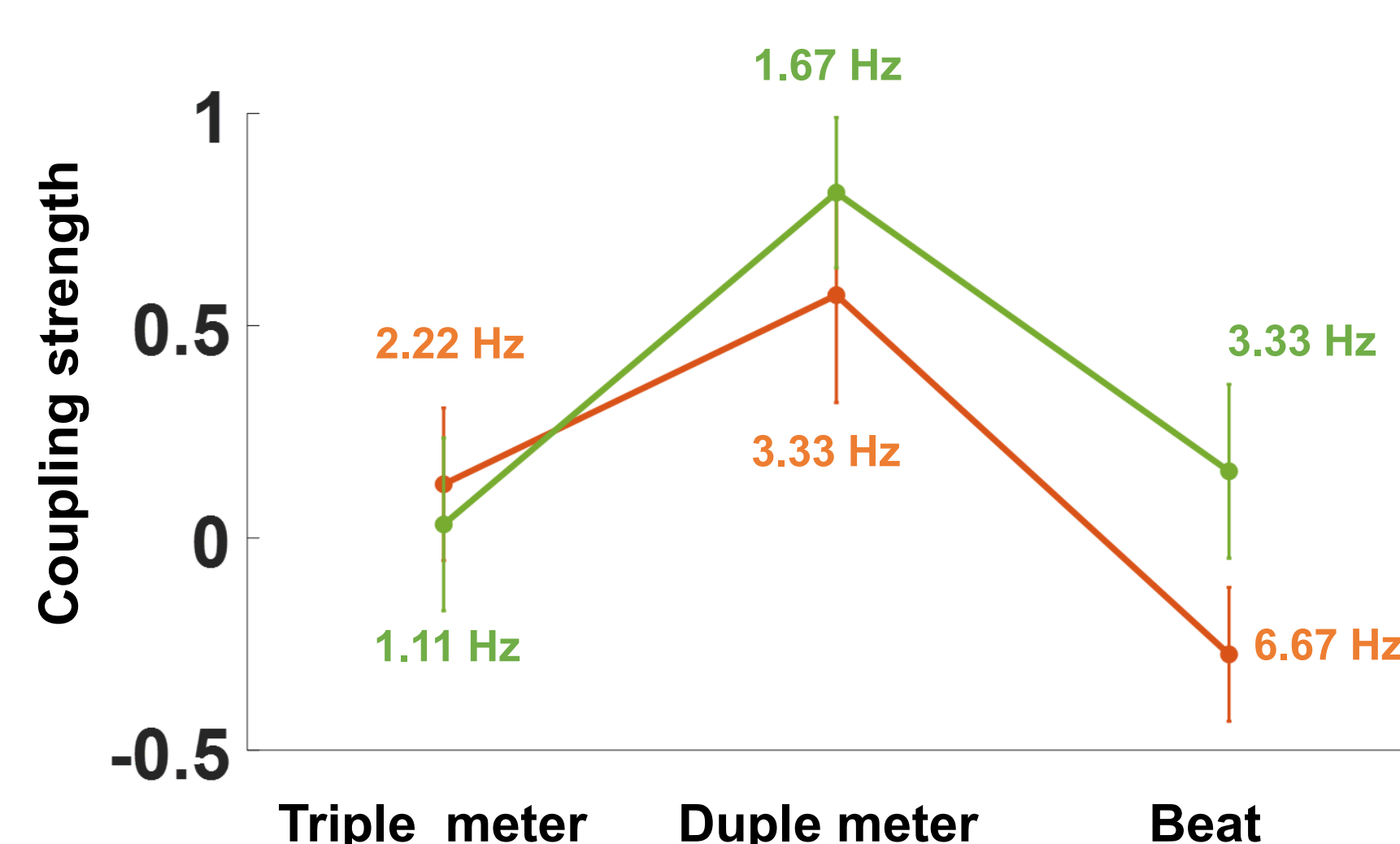
Neonates

Neonates



- Neural synchronization was enhanced for shorter cycles (faster tempo) at duple and triple meter frequencies in neonates.

Adults



- Unlike neonates, it seems beat groupings play an important role in adult meter perception.

4

Conclusion

These findings suggest that tempo plays an important role in shaping neural responses in neonates, whereas in adults, higher-order meter processing contributes more substantially to neural synchronization to the rhythmic hierarchies.

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References

- Edalati, M. et al., (2023), Journal of Neuroscience.
- Saadatmehr, B. et al., (2024), Journal of Neuroscience.

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