

Beta-band desynchronization reflects motor planning uncertainty

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Introduction

- The activity of beta-band oscillations (14-28 Hz) is known to decrease (desynchronize) during the preparation and execution of movement.
- This desynchronization decreases as the number of possible targets of a movement increases.
- Here, we investigated the effects on beta-band activity when uncertainty about the range of possible directions of movement is varied.

Methods



Figure 1. Magnetoencephalography machine at the VAHCS Brain Sciences Center.

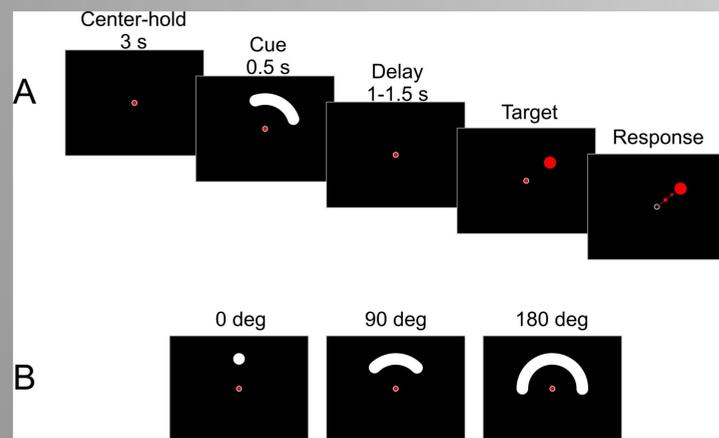


Figure 2. Schematic of the motor task. (A.) Subjects controlled a cursor using a joystick. A cue of varying size was presented showing the range of possible locations of the upcoming target. Once the target appeared, subjects moved the cursor in a straight path to the target. (B.) Conditions varied with cue sizes of 0, 90, or 180 degrees.

Results

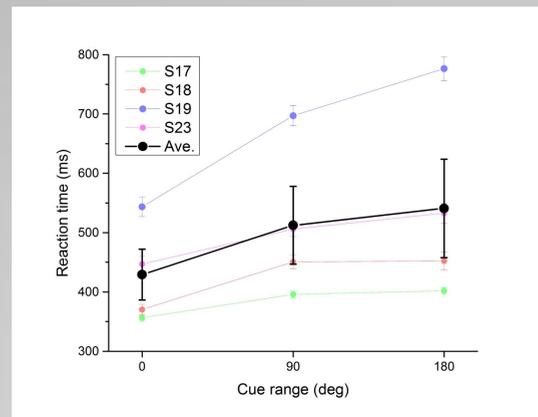


Figure 3. Reaction times across subjects and cue conditions. Reaction time increased as cue size increased.

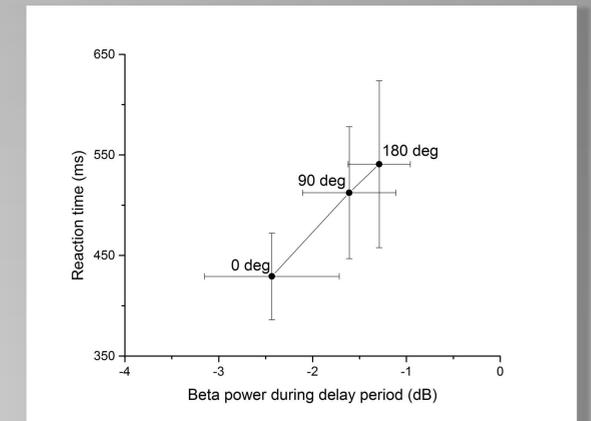


Figure 6. Reaction time versus beta power in each cue condition. Reaction time increased with beta power.

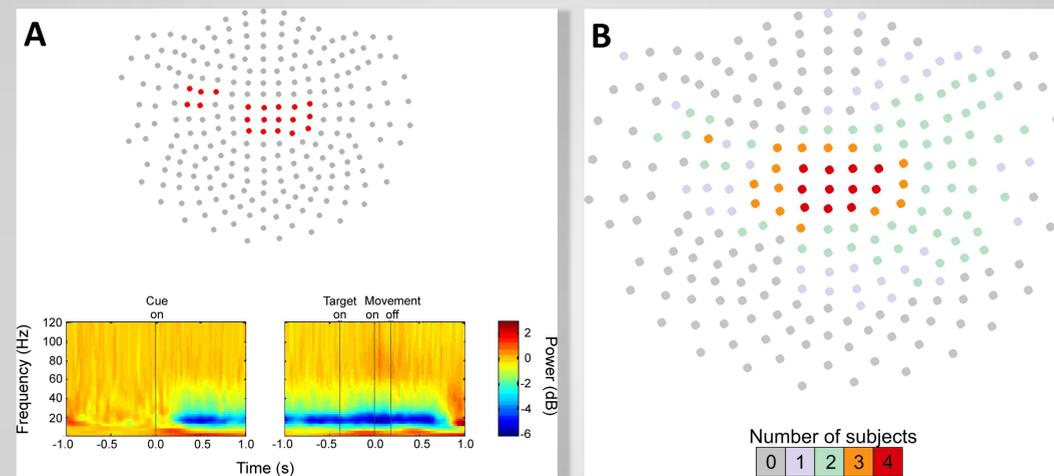


Figure 4. (A.) Example time-frequency map for a cluster of channels with strong beta desynchronization in a single subject. Beta-band power decreased after the cue was presented as well as during movement. (B.) Clustering of channels across subjects.

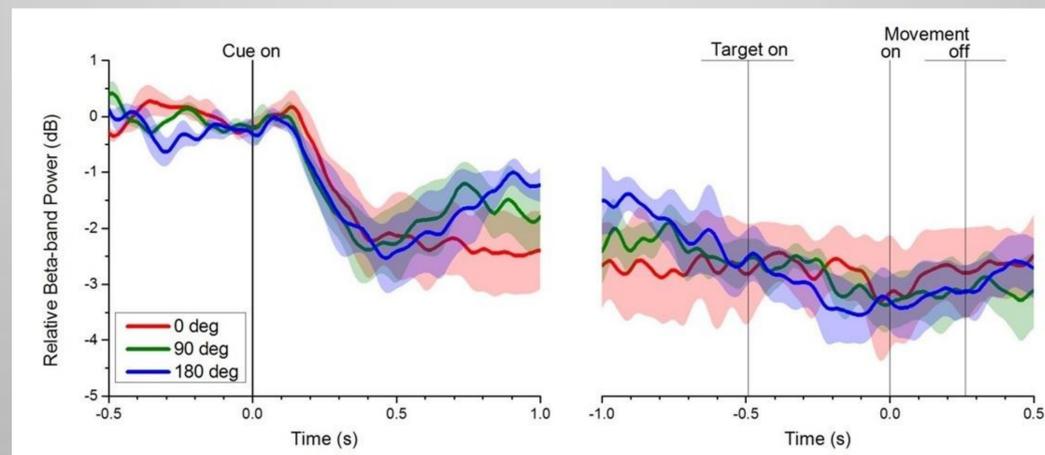


Figure 5. Beta power over time for each cue condition. Beta power stabilized to different levels after cue presentation based on cue size. Larger cue size corresponded to a smaller decrease in beta power. Beta power reduced to the same level in each condition at movement onset.

Conclusions

- Reaction time was found to increase as the size of the cue increased.
- After an initial step decrease, beta power after cue presentation was least for the smallest cues. This suggests that beta synchrony during movement preparation is associated with spatial uncertainty.
- The results suggest that reaction time is dependent on beta power during movement preparation.

References

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Acknowledgements

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