Spatial Attention Tunes Temporal Processing in Early Visual Cortex by Speeding and Slowing Alpha Oscillations

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Presented by: Sai Zhang

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Outline

1 Results

Results

Summary of 3 dimensions

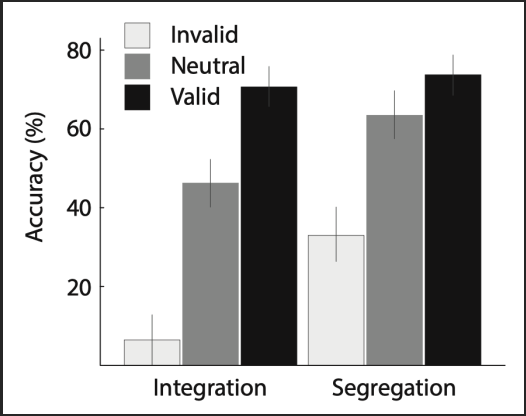
contralateral

	segregation	integration
valid		
neutral		
invalid		

ipsilateral

	segregation	integration
valid		
neutral		
invalid		

Result 1: Accuracy of Cues



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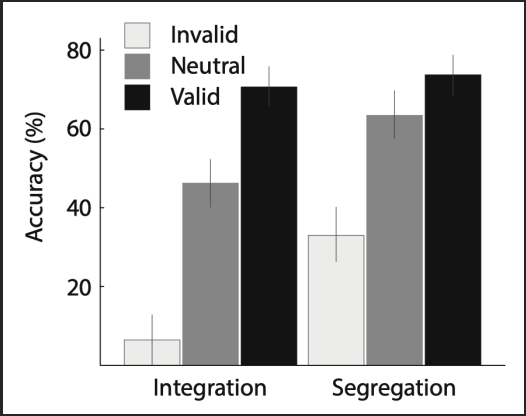

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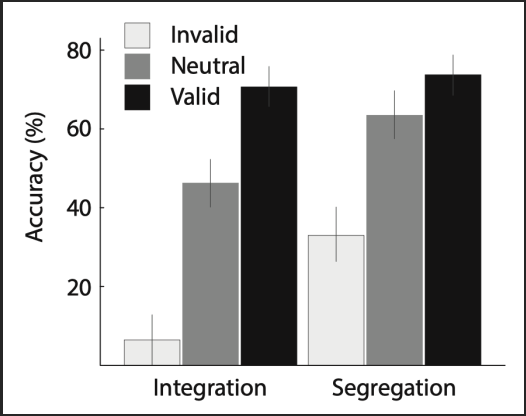

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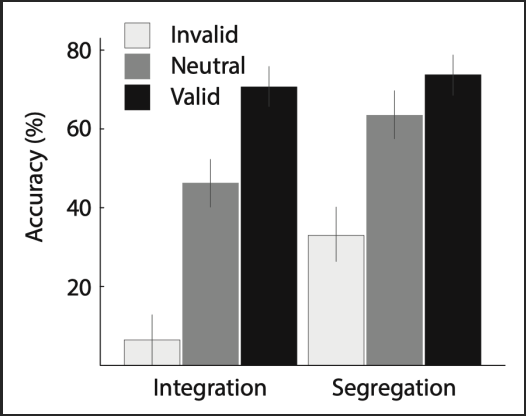
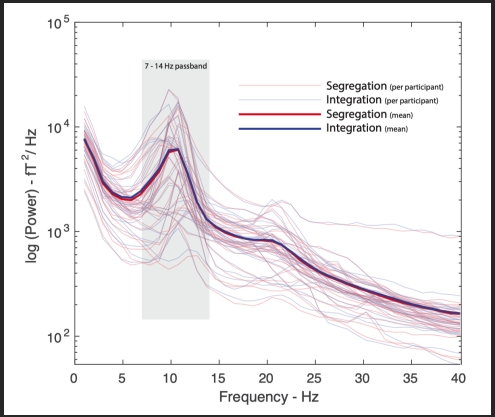


- valid cues (+), invalid cues (−)
- greater effect of cues in the segregation task
- supported by eye-tracking:
  - visual angle shifts towards the cue direction
  - no significant differences between integration and segragation

Result 2: Suitability of the Data to Measure α Frequency



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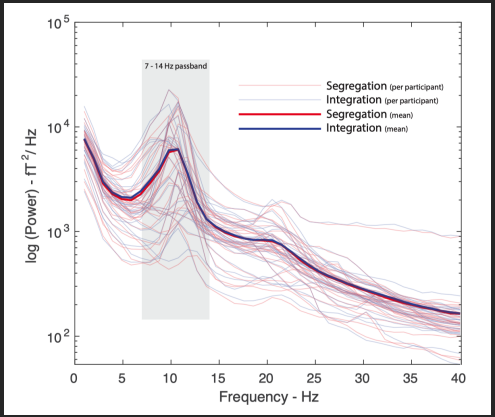

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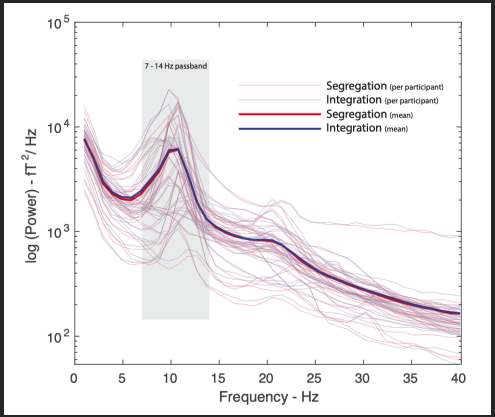
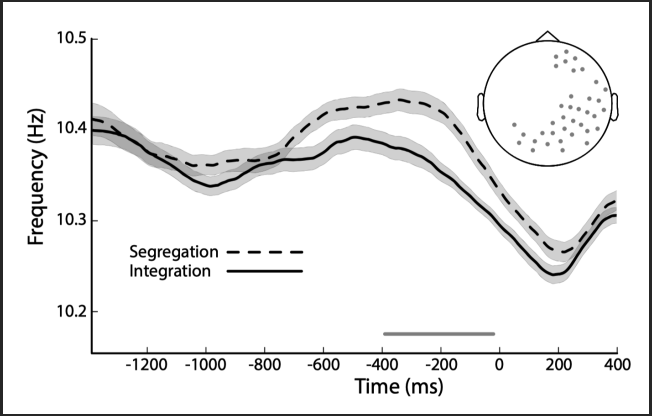


- the analytic passband (7-14Hz) contains **the peak** (In fact, the entire α bump for all participants)
- No significant difference in **power** or slope of the **1/f structure** between segregation and integration

Result 3: α Rate Is Higher for Segregation Tasks



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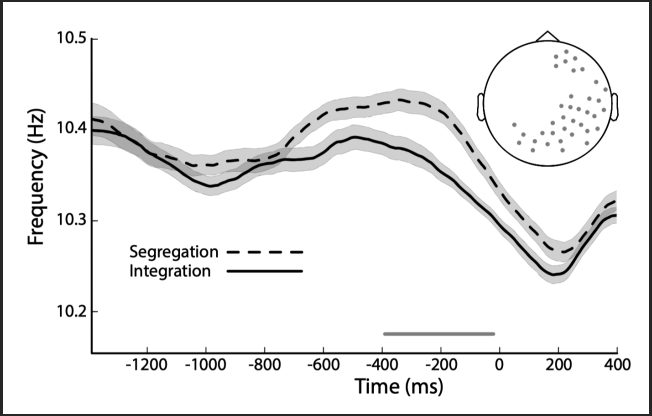

- significantly higher α rate for **segregation** before 1st display (t=0: the 1st display)

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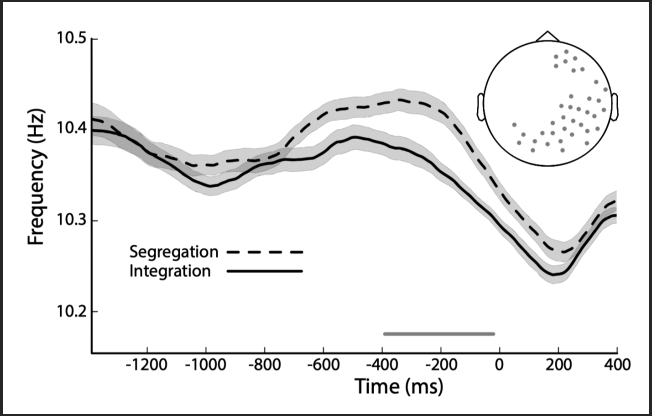
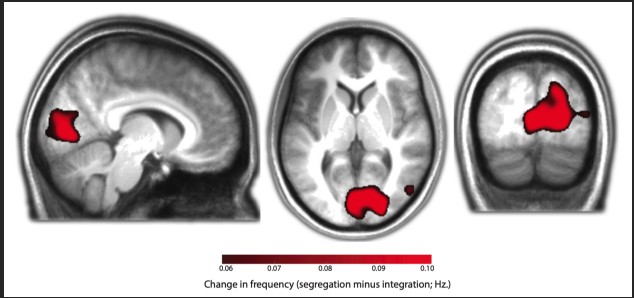


- significantly higher α rate for **segregation** before 1st display (t=0: the 1st display)
- results are from instantaneous frequency analysis of **neutral-cue** trails

Result 3: α Rate Is Higher for Segregation Tasks, Source Analysis



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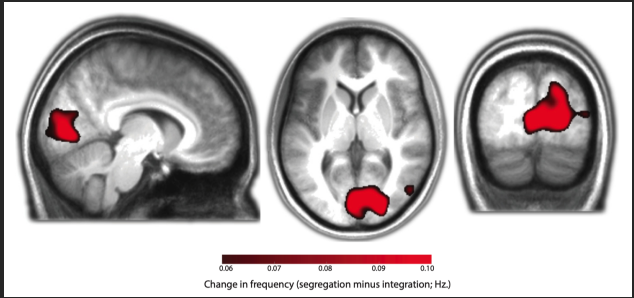

- bilateral occipito-parietal cortex
- right lateralized frontal cortex

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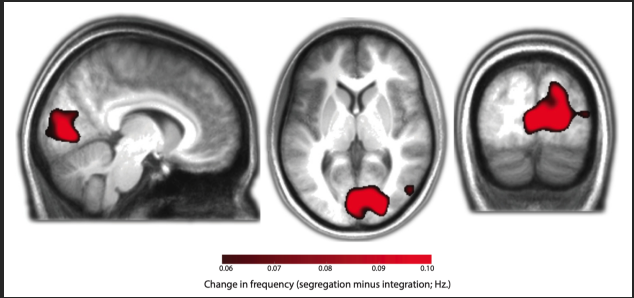

- bilateral occipito-parietal cortex
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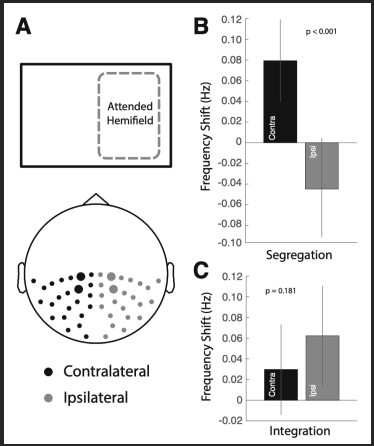
replicate the observations of Wutz et al. (2018)

Main Result: Lateral Analysis of α Frequency



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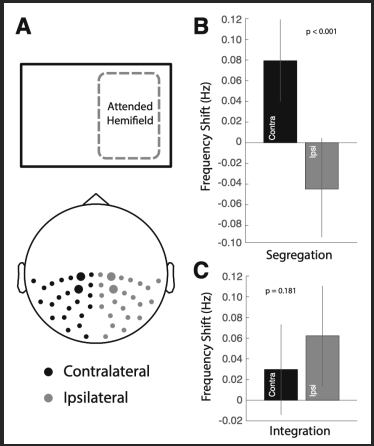

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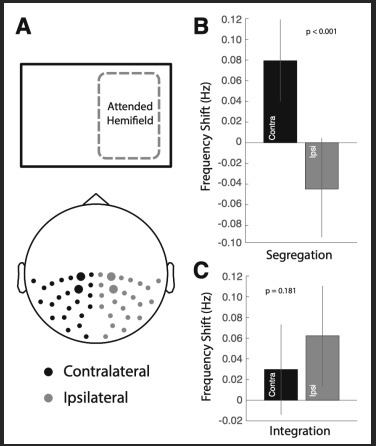

- base: any retinotopic effect **must** emerge over **posterior cortex**
- results:
  - segregation (faster α rate): contralateral **faster** than ipsilateral
  - integration (slower α rate): contralateral **slower** than ipsilateral

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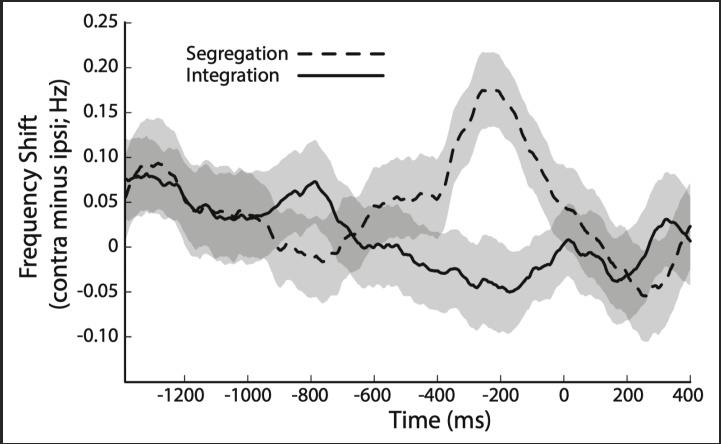
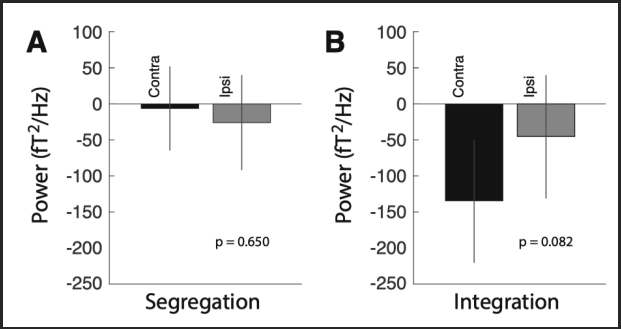


Main Result: Ruling out the Effect of Lateral Oscillatory α Power



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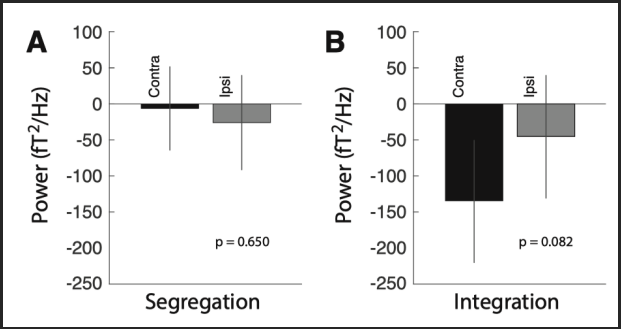
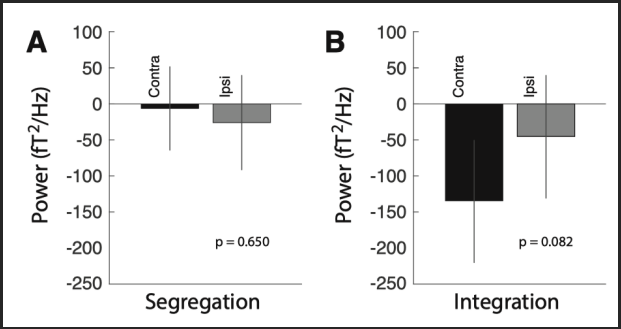


- no significant differences in the lateral effect between segregation and integration
- no significant decrease in α power in contralateral hemisphere

Main Result: Ruling out the Effect of Lateral Oscillatory α Power



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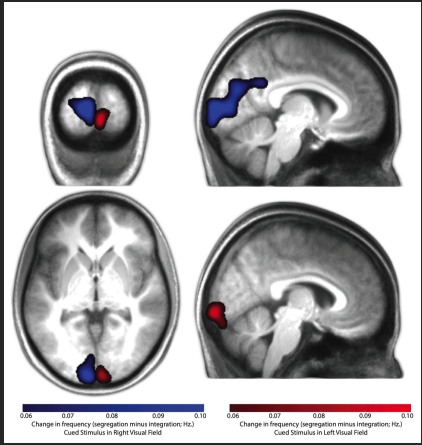
replicate the observations of Capilla et al. (2014) that the decrease in α power is sourced to **ventrolateral visual cortex**

Main Result: Lateral Analysis of α Frequency, Source Analysis



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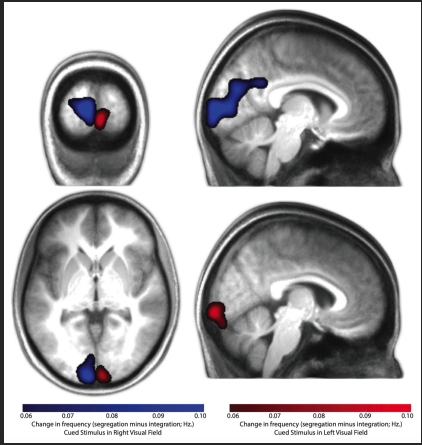

- both clusters are located in **early visual areas** at the **occipital** pole

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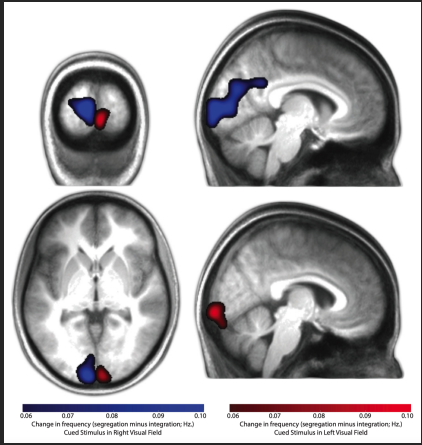

- both clusters are located in **early visual areas** at the **occipital** pole
- note:
  - **blue**: stimuli in **right** visual field
  - **red**: stimuli in **left** visual field

References I

Capilla, A., Schoffelen, J.-M., Paterson, G., Thut, G., & Gross, J. (2014). Dissociated alpha-band modulations in the dorsal and ventral visual pathways in visuospatial attention and perception. *Cerebral Cortex*, *24*(2), 550–561.

Sharp, P., Gutteling, T., Melcher, D., & Hickey, C. (2022). Spatial attention tunes temporal processing in early visual cortex by speeding and slowing alpha oscillations. *Journal of Neuroscience*, *42*(41), 7824–7832.

Wutz, A., Melcher, D., & Samaha, J. (2018). Frequency modulation of neural oscillations according to visual task demands. *Proceedings of the National Academy of Sciences*, *115*(6), 1346–1351.

Thank you!