

Ripples during human associative and non-associative memory

Jude Thom, Bernhard Staesina
Department of Experimental Psychology, University of Oxford



Introduction

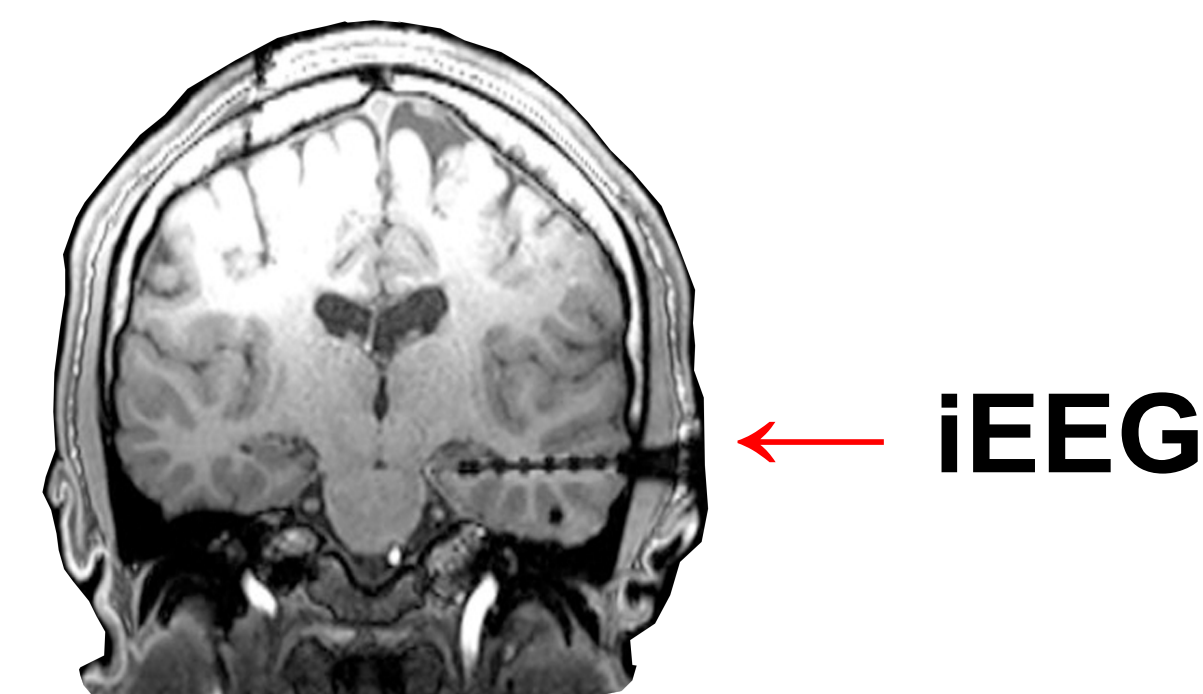
- Ripples are high frequency bursts (~ 90 Hz) in the medial temporal lobe
- Ripples during wake have been linked to successful memory retrieval in humans^{1,2}

Questions

- 1) Are ripples a regionally-specific inherent signal of the hippocampus?
- 2) How are ripple dynamics related to associative and non-associative memory demands?

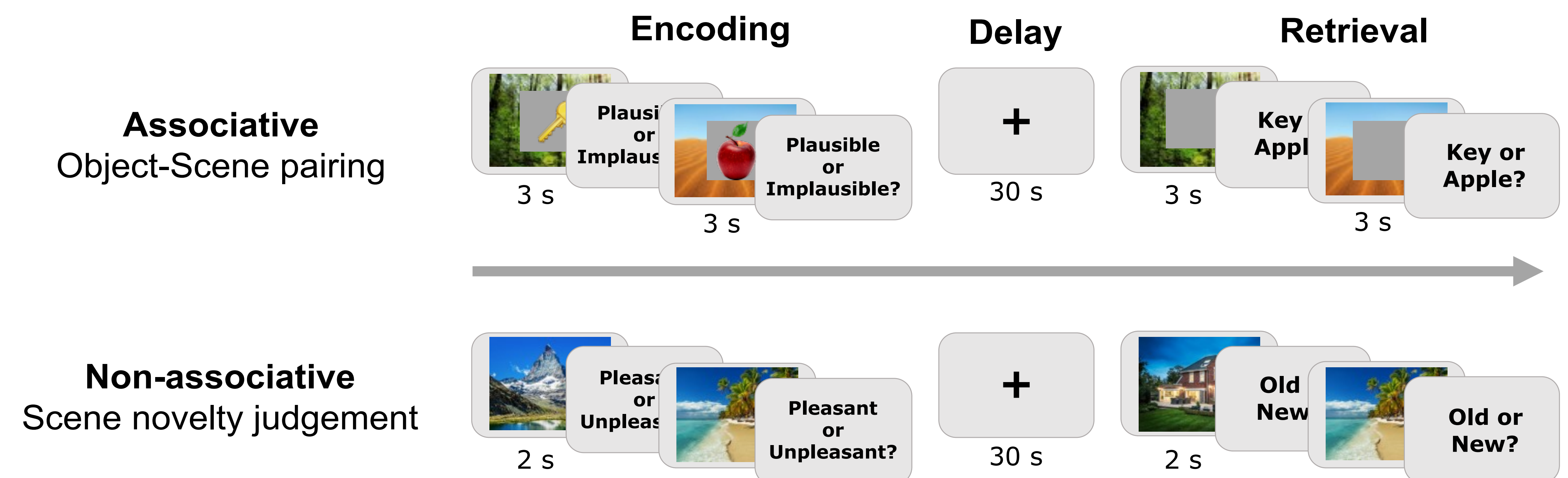
Data

- Nine patients with iEEG recordings in hippocampus and entorhinal cortex³



Task

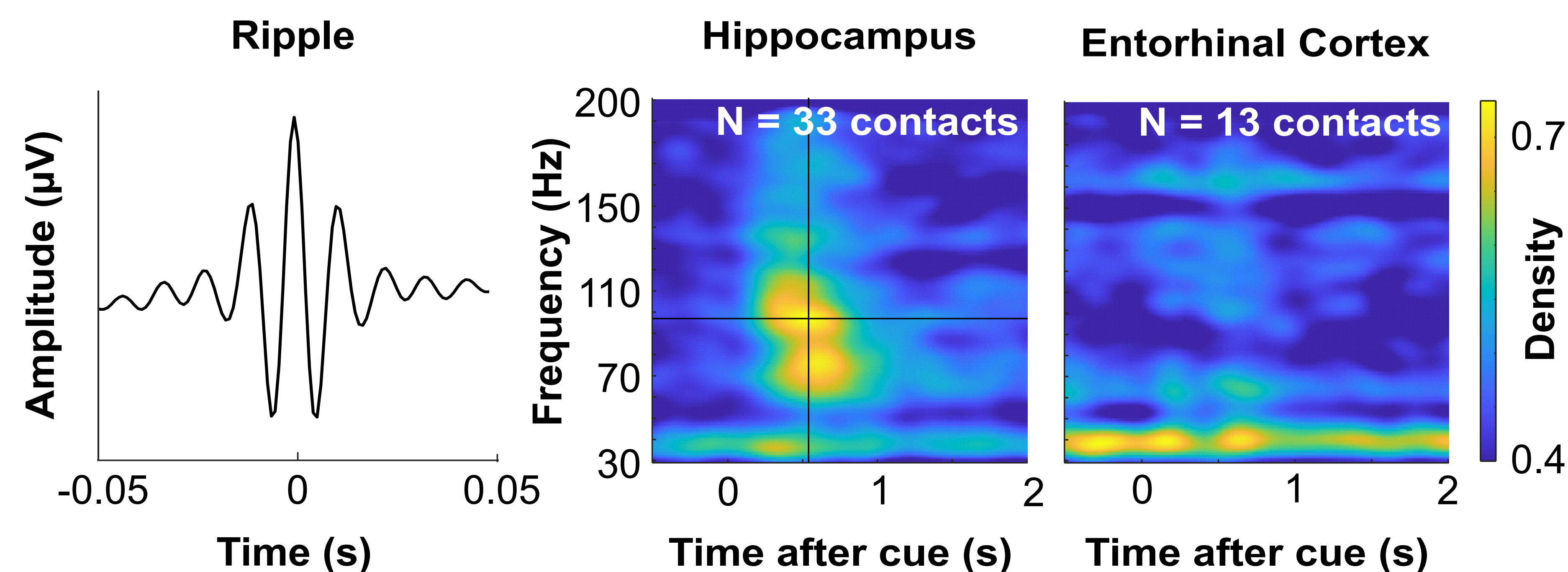
- Associative and non-associative memory tasks with interwoven blocks



Results

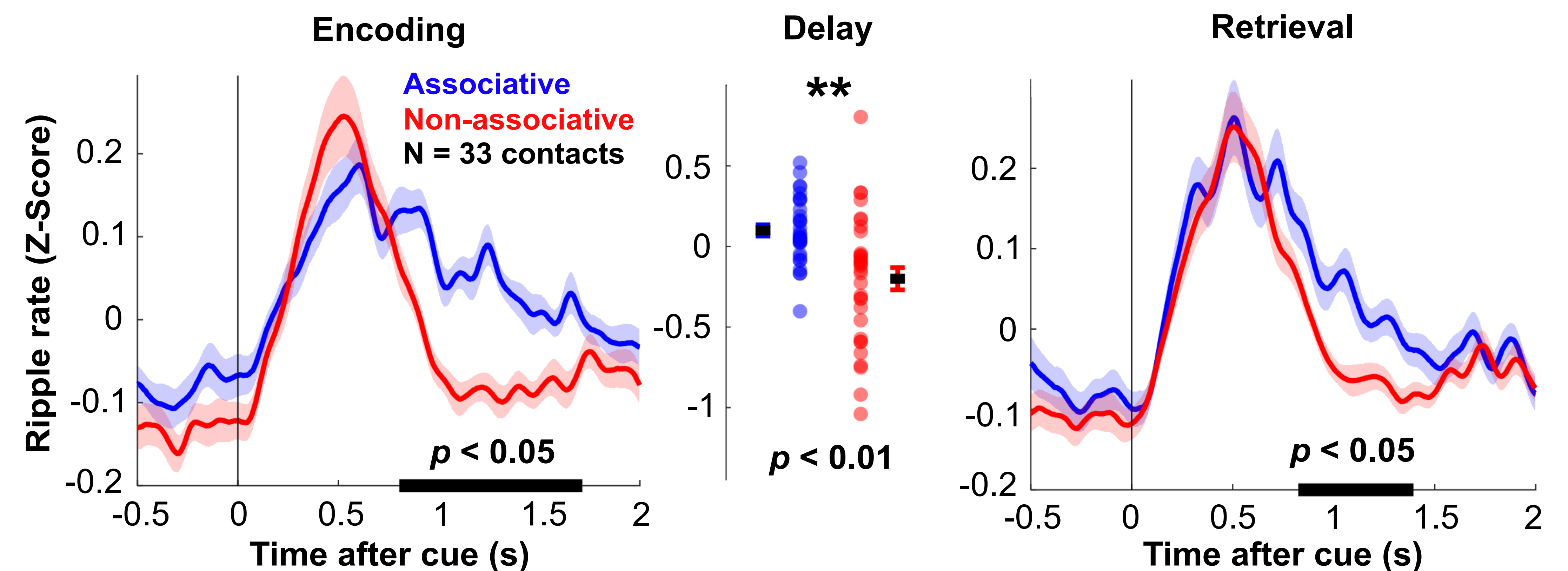
Ripples are a prominent signal in the hippocampus during retrieval

- Data-driven approach to find gamma bursts (30-200 Hz) around all memory retrieval
- Plotted peaks in time-frequency representation of gamma activity
- There are peaks in gamma matching ripple frequency (~ 90 Hz) in hippocampus
- Entorhinal cortex does not show ripple-band specific gamma peaks



Ripple activity is more persistent during associative memory tasks and delay periods

- Ripples detected as events where the envelope of 80-120 Hz activity exceeded 1 S.D. from the mean
- There is more persistent ripple activity during associative encoding, delay, and retrieval periods



Conclusions

- Ripples are a stereotyped signal specific to the hippocampus in awake humans
- Ripples are more persistent in associative memory tasks and delay periods

References

- 1) Norman et al., (Science, 2019). Hippocampal sharp-wave ripples linked to visual episodic recollection in humans
- 2) Vaz et al., (Science, 2019). Coupled ripple oscillations between the medial temporal lobe and neocortex retrieve human memory
- 3) Staesina et al., (Nat.Comm., 2019). Recollection in the human hippocampal-entorhinal cell circuitry