Enhancing recall with imperceptible sensory stimulation

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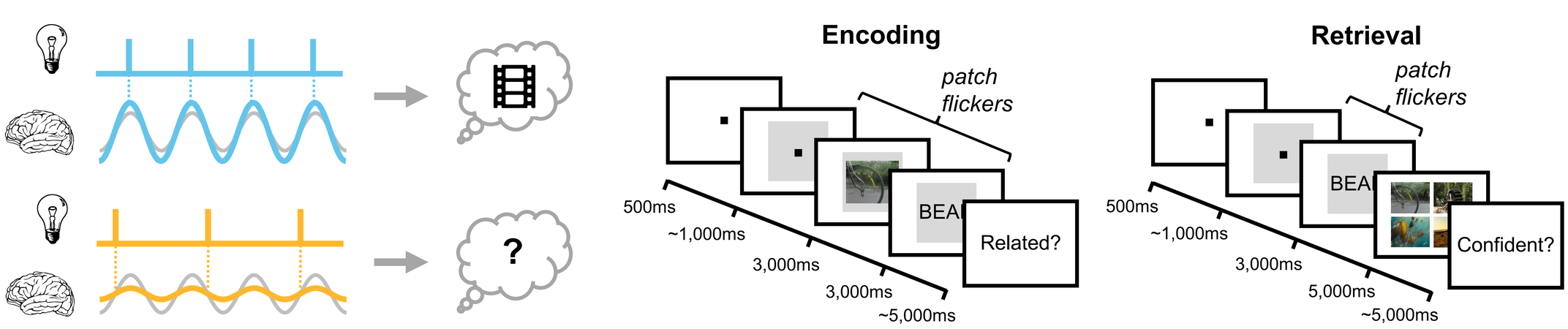
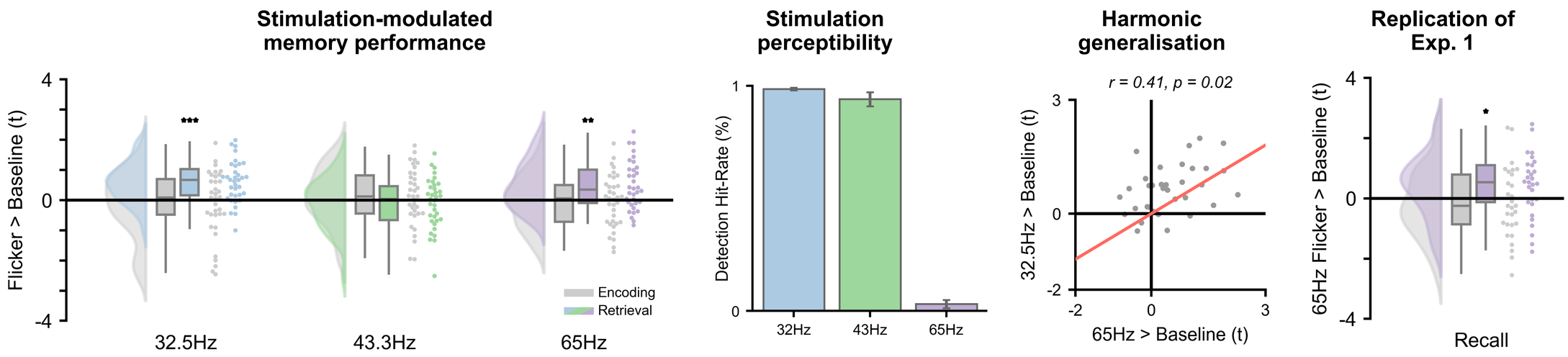
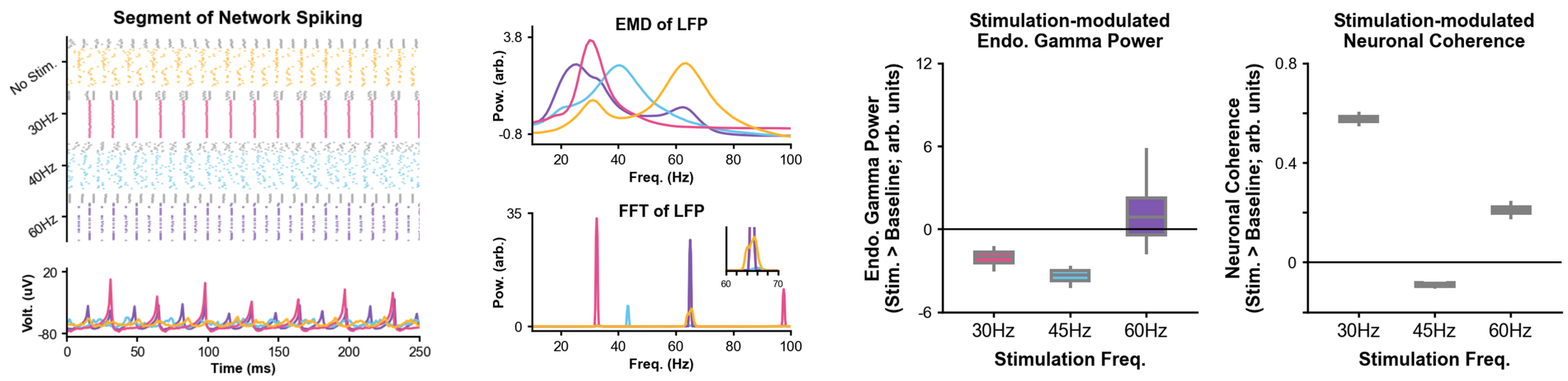
1) Gamma band activity correlates with the successful recall of episodic memories[e.g., 1, 2], but is this a cause or consequence of the retrieval process? We used sensory stimulation to modulate ongoing gamma-band activity[3] and explore it's impact on memory performance (left schematic) in an episodic memory task (right schematic).



2) 65Hz stimulation (and its subharmonic) boosts recall relative to baseline (far left; coloured plots). No effect was observed following 43.3Hz stimulation, or following stimulation at encoding (far left; grey plots). Participants could not perceive 65Hz stimulation (middle left). Those who benefited from 65Hz stimulation also benefitted from 32.5Hz stimulation (middle right). Enhancement effects replicate in an independent sample (far right).



3) Computational modelling suggests the results are best described by the entrainment of an endogenous ~65Hz gamma oscillation, leading to greater synchrony between single Izhikevich neurons[4]. 65Hz and 32.5Hz exogenous stimulation enhances neuronal entrainment driven by endogenous 65Hz oscillation (far left, middle left). Stimulation-driven enhancements in neuronal coherence (far right), but not local field potential (middle right), match behavioural effects.



4) Summary

- 65Hz sensory stimulation acts as an imperceptible intervention to enhance recall.
- Computational modelling suggests this effect is due to entrainment of an endogenous gamma oscillation.
- Future neuroimaging work will be needed to ascertain where this endogenous gamma oscillation is located.
- The lack of effects at encoding suggest stimulation aids a retrieval-specific process, but it remains to be seen which process this is.

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