Activity-Silent Short-Term Memory for Language Processing

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Presentation Abstract Summary Integrating meaning over time requires memory ranging from milliseconds (words) to seconds (sentences) and minutes (discourse). How do brain circuits support maintenance across these time-scales? Here we investigate the nature of short-term memory in a neurobiologically motivated model of sentence comprehension.

Sparsely connected networks of spiking neurons were exposed to input sentences and their syntactic alternations. The task was to incrementally map these word sequences onto semantic roles (who did what to whom?). To probe memory, we systematically manipulated network connectivity, properties of neuronal adaptation, and the shape of synaptic currents. Near optimal performance was observed when time constants were tuned to the temporal characteristics of the comprehension task. Recurrent connectivity only played a limited role in maintaining information over time.

Results suggest that memory for language may be provided by activity-silent dynamic processes rather than persistent spiking activity as in standard models of short-term memory.

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