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How does the brain tell time?

Much of the information the brain processes and stores is temporal in nature—speech and music, for example, are defined as much by how they unfold in time as by their spectral structure. The brain seamlessly assimilates the order and duration of sensory events, and generates finely timed motor responses. These abilities are critical to most behaviors: from reward anticipation to sensorimotor processing. We have proposed that timing on the scale of milliseconds to seconds relies on population clocks: time-varying patterns of neural activity that emerge from the dynamics of recurrent neural networks (RNNs). And more generally, that dynamic attractors—locally stable neural trajectories—represent a fundamental computational strategy in the brain. We provide computational and experimental support for this hypothesis, and suggest that precisely because timing is such a fundamental computation, that most neocortical circuits are inherently capable of timing.