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Time flies: Hippocampal time cells represent the distant past with less resolution

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Abstract

Hippocampal time cells carry a record of recent experience by firing during a circumscribed period of time after a triggering stimulus. Different cells have “time fields” at different delays up to at least tens of seconds. The observation that time fields representing events further in the past are wider supports the hypothesis that the more distant past is recorded with less resolution. However, previous studies have analyzed time fields averaged over trials, leading to the possibility that this could be a trial-averaging artifact. We analyzed single-unit recorded time cells with a hierarchical-Bayesian model that separately estimated within-trial receptive field width and across-trial variability. Even after isolating across-trial variability, time-field width covaries with delay, consistent with less resolution for past events. Moreover, the shift of time-fields for simultaneously recorded time cells correlates with each other, suggesting that time runs at different rates for the population from one trial to the next.