

# Experience-dependent Dynamics of Spatio-temporal Precision and Synchrony in Place Cells

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abstract

## I. INTRODUCTION

## II. METHODS AND MATERIALS

### A. Experimental setup and data collection

### B. Data analysis

### C. Adaptive filtering

## III. RESULTS

## References

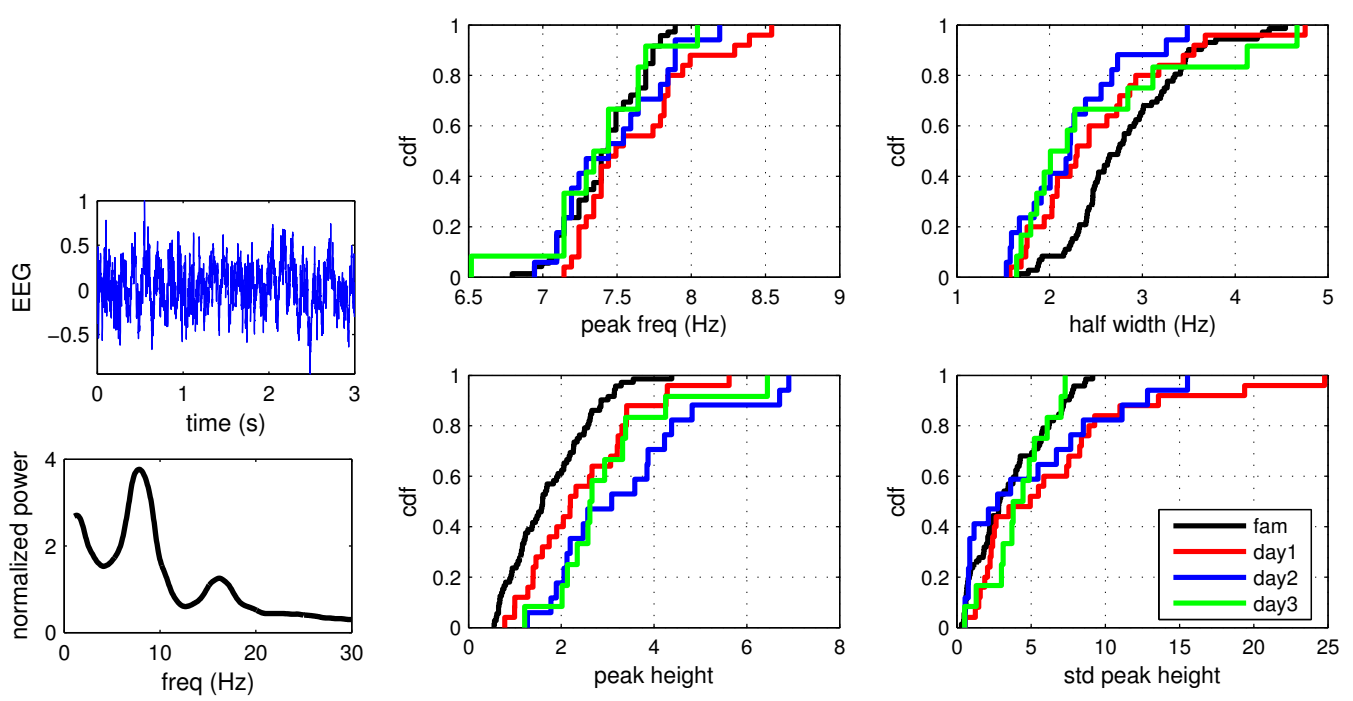
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**FIG. 1 Power spectral density in the theta frequency band (6–10Hz) does not differ between familiar configuration and novel arm.**

A: Periodic theta oscillations are visible in this example of an unfiltered EEG trace.

B: Power spectral density (PSD) of EEG recorded at one tetrode. Power spectral density calculated using multi-taper method with minimum time window width of 1s on *normalized* signal. Only times when animal were running (velocity > 4cm/s), and located on outer arm (center+5cm <  $x$  < center+70cm). For novel days only novel arm. In each PSD we identify the location, half-width-at-half-height, height, and std of height of the peak at theta frequency.

C–F: Comparison of distributions of theta peak properties across different novelty condition. fam:  $n=76$ , day1:  $n=25$ , day2:  $n=20$ , day3:  $n=14$ . failure to find peaks in fam: 4, day1: 0, day2: 3, day3: 2. EEG was analyzed only for those tetrodes that contributed a cell with included place field. (pf8-fam and pf8-novelArm). The distribution of the four spectral quantities during all novel exposures were tested against the distribution in the familiar configuration using the Kolmogorov-Smirnov (KS) test and Wilcoxon ranksum test. Comparing peak freq (Hz), 1 vs 2: KS test  $p=0.0123$ , ranksum  $p=0.0396$  Comparing peak freq (Hz), 1 vs 3: KS test  $p=0.2989$ , ranksum  $p=0.6573$  Comparing peak freq (Hz), 1 vs 4: KS test  $p=0.9122$ , ranksum  $p=0.7736$  Comparing half width (Hz), 1 vs 2: KS test  $p=0.0141$ , ranksum  $p=0.0177$  Comparing half width (Hz), 1 vs 3: KS test  $p=0.0013$ , ranksum  $p=0.0006$  Comparing half width (Hz), 1 vs 4: KS test  $p=0.0051$ , ranksum  $p=0.0355$  Comparing peak height, 1 vs 2: KS test  $p=0.0926$ , ranksum  $p=0.0066$  Comparing peak height, 1 vs 3: KS test  $p=0.0009$ , ranksum  $p=0.0000$  Comparing peak height, 1 vs 4: KS test  $p=0.0026$ , ranksum  $p=0.0007$  Comparing std peak height, fam vs day1: KS test  $p=0.0527$ , ranksum  $p=0.0330$  Comparing std peak height, fam vs day2: KS test  $p=0.5228$ , ranksum  $p=0.7266$  Comparing std peak height, fam vs day3: KS test  $p=0.1050$ , ranksum  $p=0.3035$

nice sample  
autocorrelogram fam

analyses of peaks and regularity

nice sample  
autocorrelogram novel

nice sample  
cross-correlogram fam

analyses of peaks and regularity

nice sample  
cross-correlogram novel

FIG. 2 Theta modulation is fine.

sample snapshot of phase precession plot

FIG. 3 sample snapshot of phase precession plot

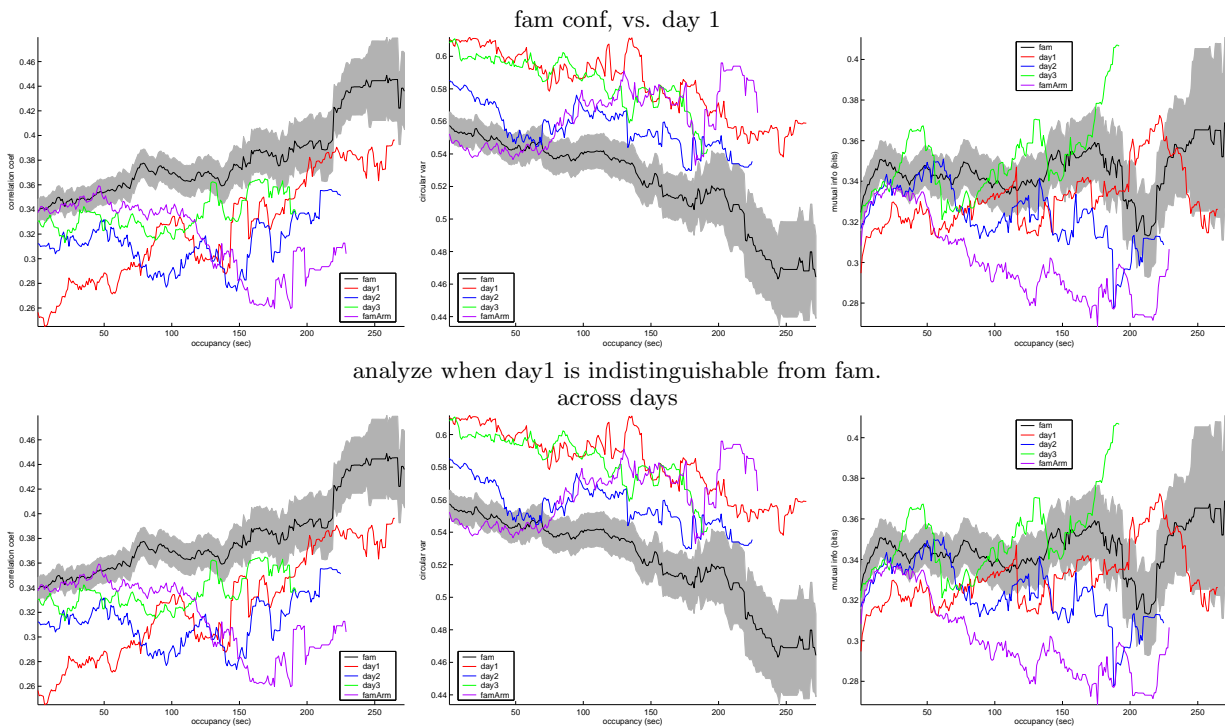


FIG. 4 Dynamics of phase precession in novel arm. Hilbert transform, different EEG reference, velocity criterion. pf7

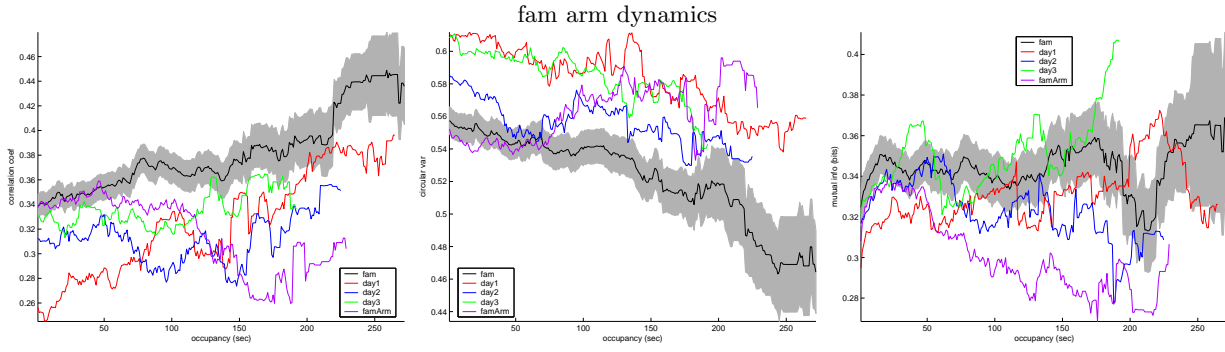


FIG. 5 Dynamics of phase precession in fam. arm. Hilbert transform, different EEG reference, velocity criterion. pf7

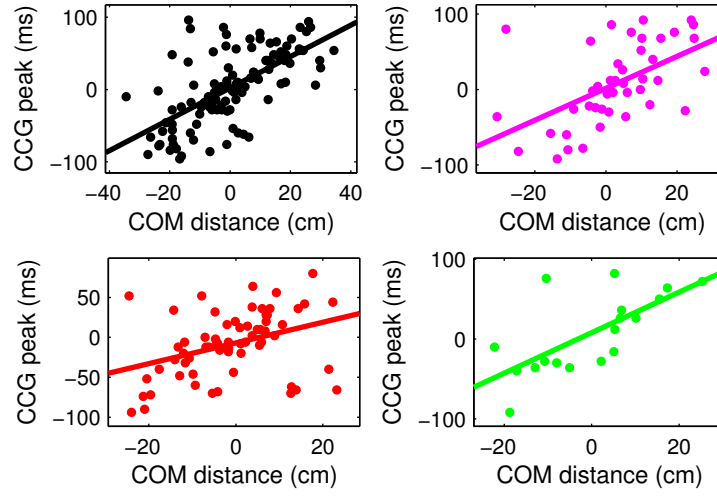


FIG. 6 fam, corr:  $r = 0.651$ , (0.528, 0.747)  $p = 1.4e-14$ ,  $n = 110$  day-1, corr:  $r = 0.368$ , (0.137, 0.562)  $p = 0.0025$ ,  $n = 65$  day-2, corr:  $r = 0.914$ , (0.398, 0.991)  $p = 0.011$ ,  $n = 6$  day-3, corr:  $r = 0.690$ , (0.328, 0.875)  $p = 0.0015$ ,  $n = 18$  fam-arm, corr:  $r = 0.546$ , (0.298, 0.725)  $p = 0.00013$ ,  $n = 44$  "fam" vs. "day-1":  $p = 0.014$  "fam" vs. "day-2":  $p = 0.185$  "fam" vs. "day-3":  $p = 0.799$  "fam" vs. "fam-arm":  $p = 0.372$

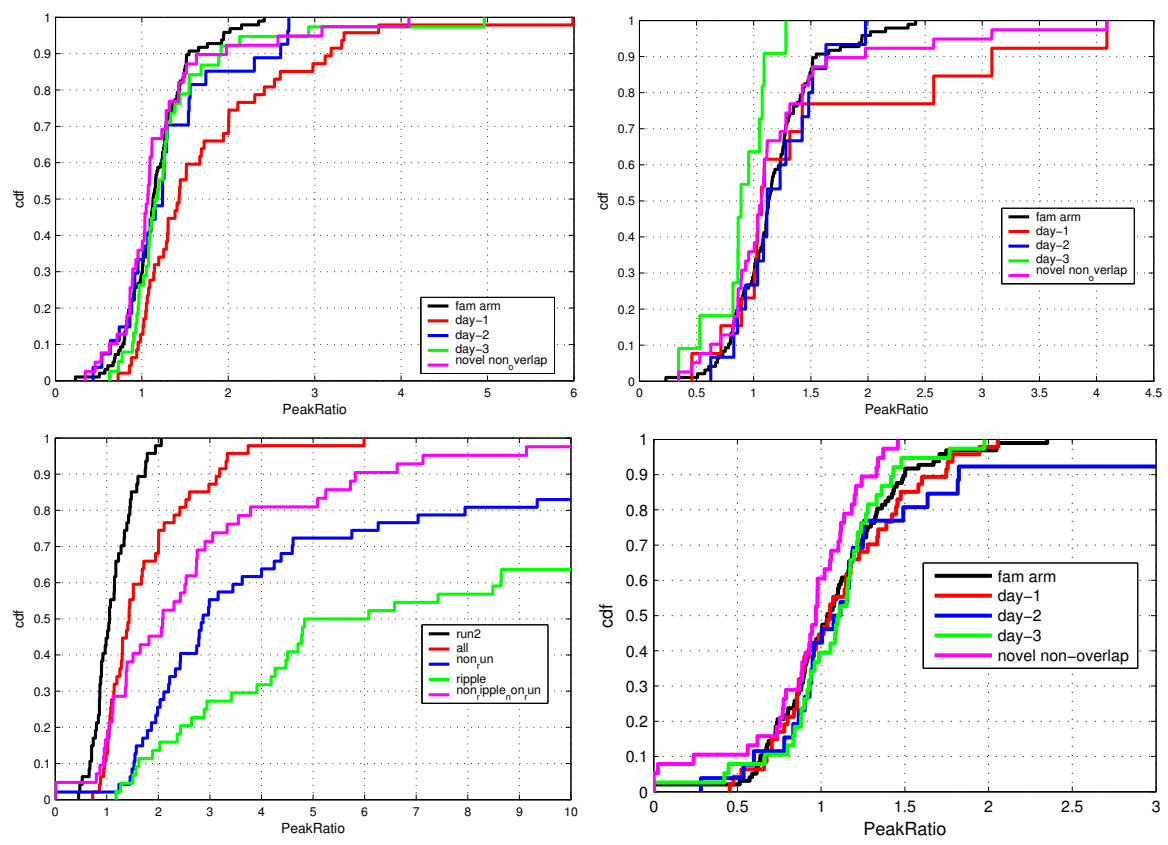


FIG. 7 peak ratio: fam. arm vs. non-overlapping novel, all spikes  
peak ratio, novel arm, day 1, different behavioral context, pf7

## Sample of cell pair spiking in environment

FIG. 8 Sample of cell pair spiking in environment.

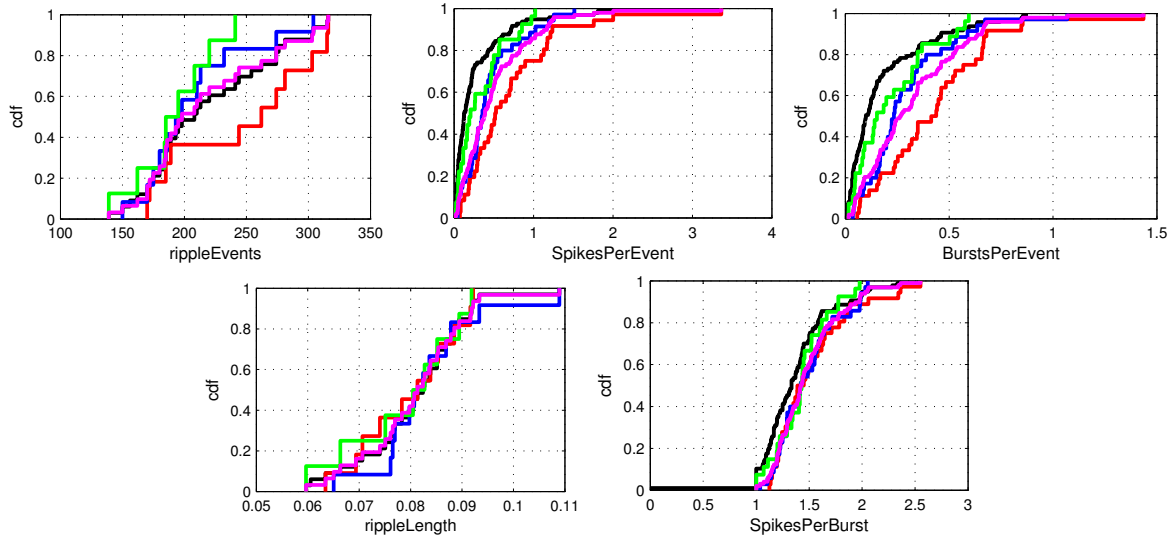


FIG. 9 ripple control: number of ripple events