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Supplemental Data

Article

Reverberation of Recent Visual Experience

in Spontaneous Cortical Waves

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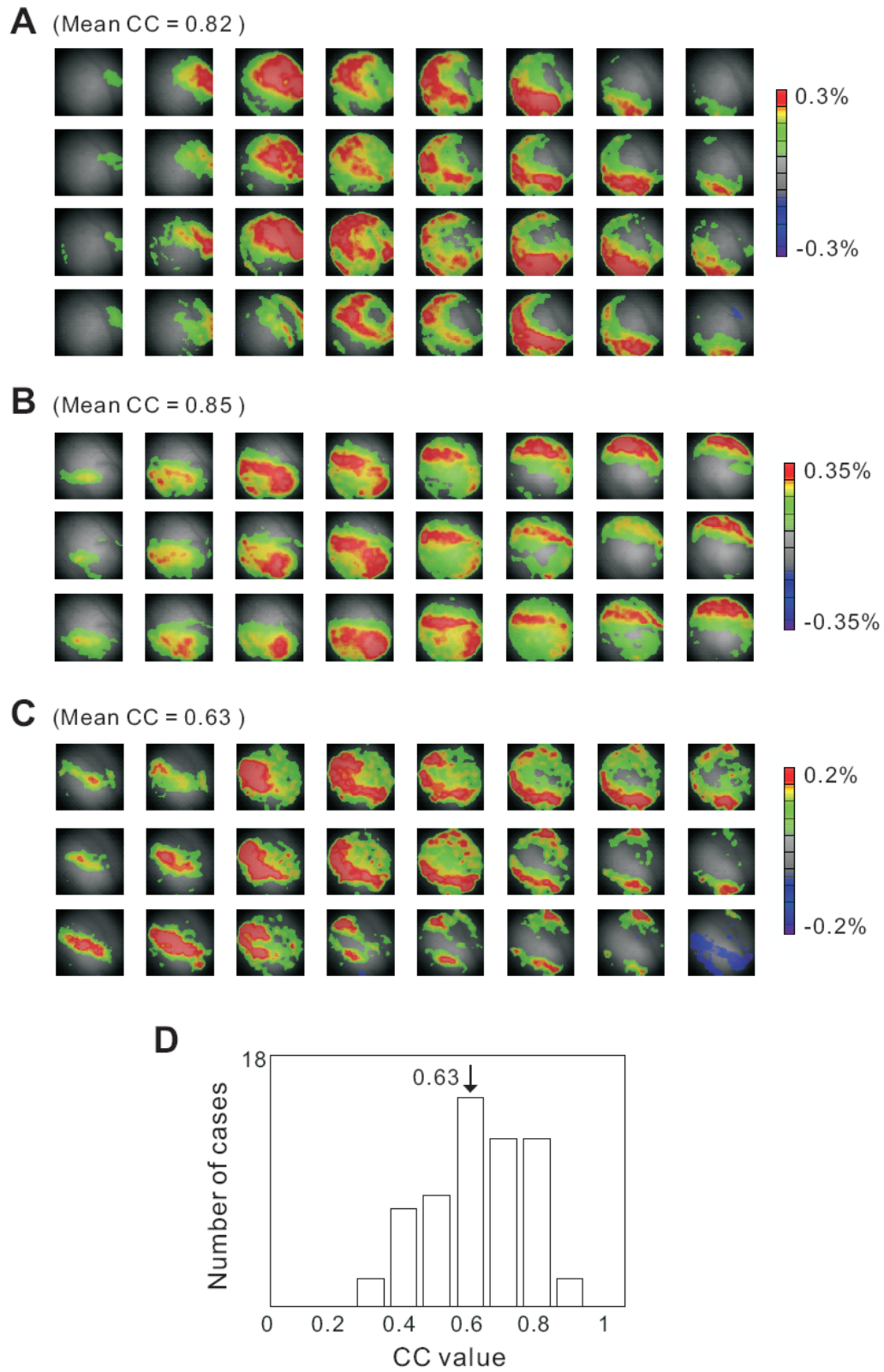


Figure S1.

Figure S1. Cortical Waves Evoked by Identical Stimuli in Different Trials

(A) Waves evoked by a bright square flashed at a given stimulus position in four trials; the mean CC across all pairwise combinations of trials is 0.82.

(B and C) Similar to (A), but recorded in different animals; mean CC: 0.85 (B) and 0.63 (C).

(D) Distribution of CCs between waves evoked by the same stimulus in different trials. Arrow indicates mean of the distribution (0.63 ± 0.02 , SEM, $n = 58$), which is significantly higher than the mean CC between the spontaneous and the evoked waves (0.46 ± 0.01 , SEM, $n = 97$, $p < 10^{-8}$, Mann-Whitney U test) and the mean CC between waves evoked by different stimuli (0.43 ± 0.02 , SEM, $n = 100$, $p < 10^{-8}$, Mann-Whitney U test). The mean CC between waves evoked by different stimuli was not significantly different from the mean CC between spontaneous and evoked waves ($p > 0.4$, Mann-Whitney U test).

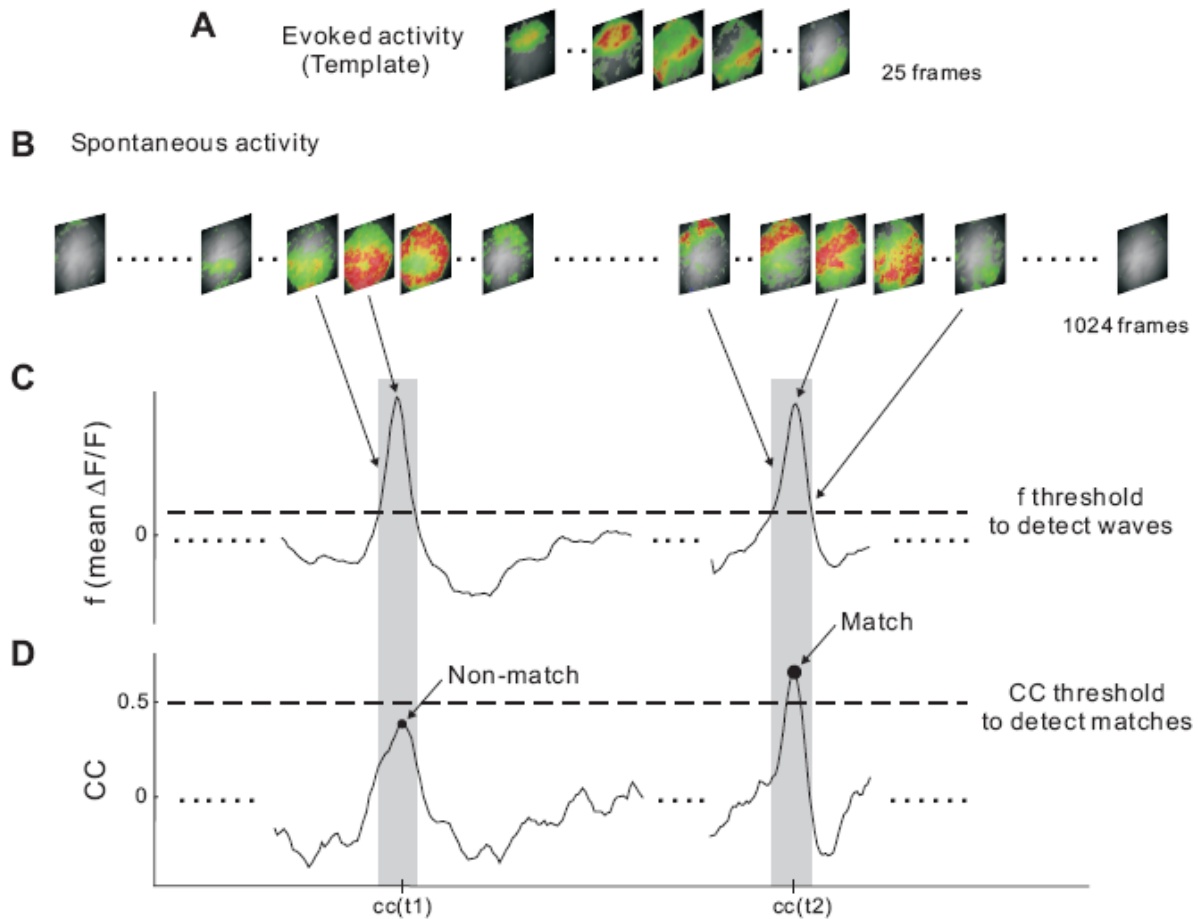


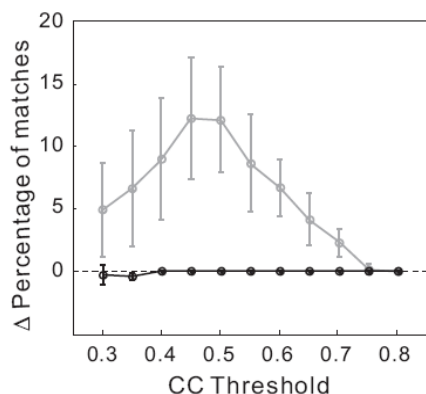
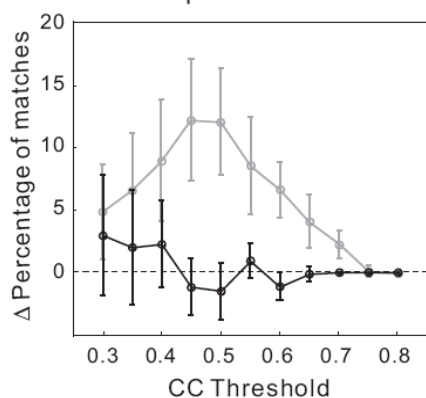
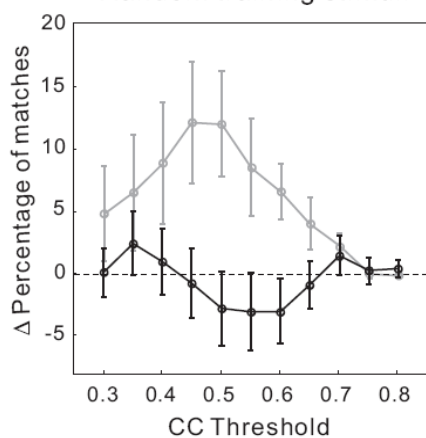
Figure S2. Procedure for Identifying Matches between the Spontaneous Waves and the Evoked Template

(A) Spatiotemporal pattern of activity in response to a visual stimulus, used as the template.

(B) Activity in a 10.24 s spontaneous recording session.

(C) The spatial average of $\Delta F/F$ (f) during the spontaneous recording session. Arrows indicate f values for several frames of the spontaneous recording. Dashed line: threshold at 70% quantile of the f value in the spontaneous session, used to identify periods corresponding to waves (gray shading).

(D) Pearson correlation coefficient (CC) between the template and the spontaneous activity as a function of t . Dot: CC value at the optimal alignment between the spontaneous and evoked waves. Dashed line: CC threshold at 0.5, used to identify spontaneous waves that are matched to the evoked template.

A Randomized spontaneous activity**B** Rotated spontaneous activity**C** Random training stimuli**Figure S3. Control Analyses and Experiment**

(A) Training-induced change in the percentage of matches between spatially randomized spontaneous activity and the evoked template plotted against the CC threshold (black line). Error bar: \pm SEM. Data and analyses are the same as shown in Figure 2D (30 training experiments, 9 rats), except that in each frame of the spontaneous activity the pixels are shuffled randomly.

(B) Same as (A), except that each frame of the original spontaneous activity was rotated 180° . Compared to the pixel randomization procedure in (A), which preserves the spatial average of $\Delta F/F$ in each frame, the rotation procedure in (B) also preserves the speed and spatial extent of wave propagation.

(C) Changes in the percentage of matches between the spontaneous waves and the evoked templates induced by presentation of 50 flashes randomly distributed over the nine positions at 0.6 Hz (black line, data are from 19 training experiments, 6 rats). Gray line in all three plots: result of training with 50 flashes at a single position (same as in Figure 2D), shown here to facilitate comparison.

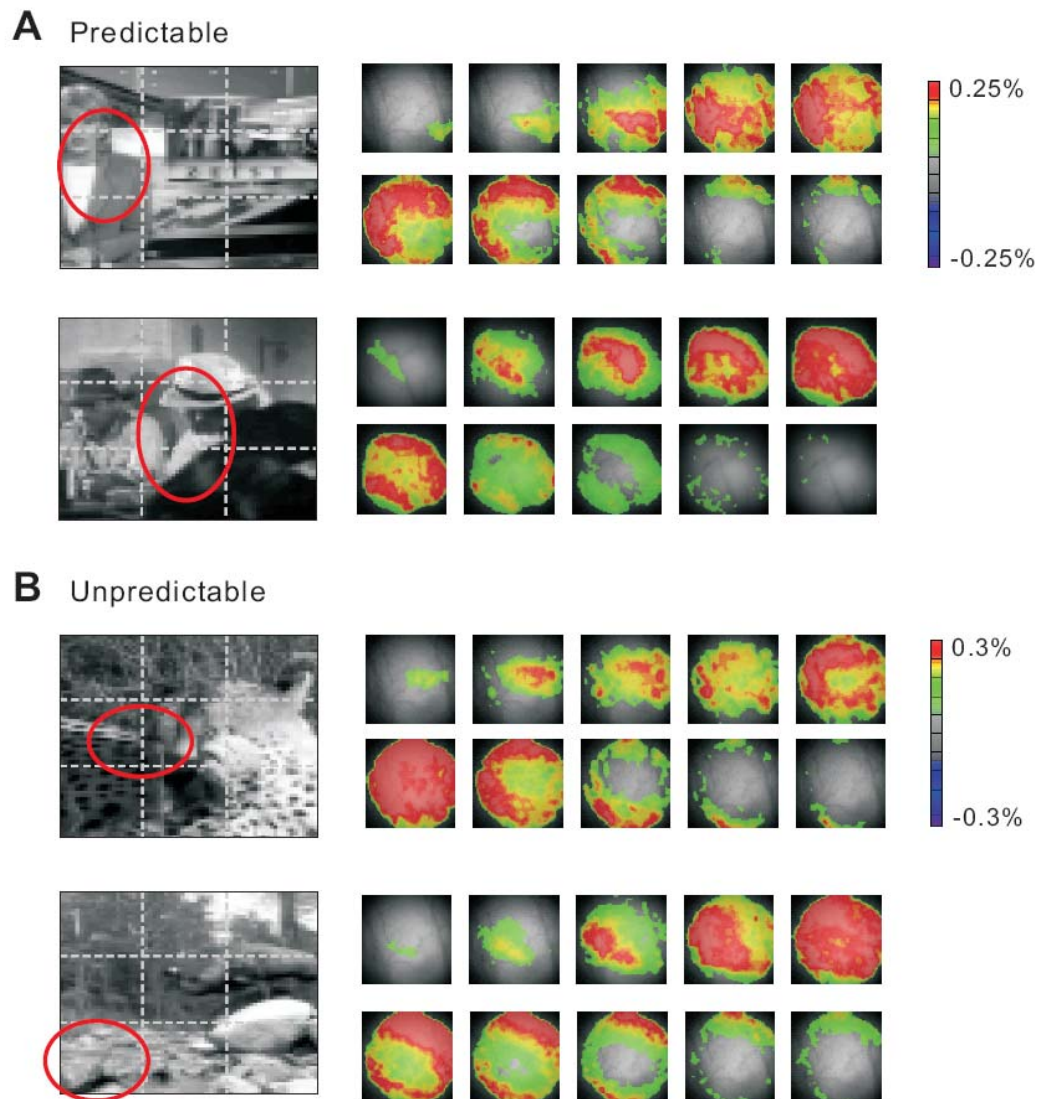


Figure S4. Cortical Waves Evoked by Natural Images

(A) Examples of waves (shown in 20 ms intervals) with initiation sites predictable from the luminance patterns of the natural images (shown on the left). VSD signal was color coded. The red oval indicates the estimated stimulus location corresponding to the wave initiation site, based on the retinotopic map measured with flashed squares. Note that these estimated stimulus locations roughly correspond to the brightest areas in the images.

(B) Examples of waves with initiation sites not easily predictable from the luminance patterns. The estimated stimulus locations do not correspond to the brightest areas in the images. The two waves were recorded in the same animal.