Supplemental Figure Legends

Figure S1. Confirming electrode location and plotting receptive field location. ***A*:** To confirm that the electrode arrays were correctly inserted into V1, after each experiment, the tissue was flattened, frozen, sectioned and stained for CO. Electrodes were considered in V1 if they were located in the region that stained positively for CO blobs. Serial section reconstructions were done to determine electrode locations relative to the CO blobs in V1. In this picture, the edges of the array are most prominent in the anterior and medial aspects of the section. A – anterior, M – medial. ***B*:** Receptive field plots for the same case. The black square represents the *area centralis*.

Figure S2. Reconstruction of the electrode tracks. This figure illustrates the procedure used to reconstruct the electrodes in the array and determine their laminar depth and position relative to the border of V1 in one case, 05-11. ***A* - *D*** show alternate cytochrome oxidase (CO) stained tangential sections progressing from dorsal to ventral. The dashed white line marks the border of V1 and V2 at the anterior end (top) of each section. Medial is to the right. The CO blobs located in cortical layer 3B are clearly visible in **C.** ***E* - *H*** are drawings of ***A* - *D*** showing the positions of the electrodes as red dots and the V1 border as a black dashed line within each section. In the final section, representing a portion of cortical layers 4 and 5, all evidence of the electrode holes have disappeared. See text for details.

Figure S3. Stability of spike waveforms throughout the duration of the experiment. To increase the probability that responses were measured for the same neurons throughout the course of the experiments, only neurons whose spike-waveforms were qualitatively similar in shape at the beginning and end of each experiment were used. This figure shows the waveforms for two neurons on two different channels for the first block and last block, recorded about 3.5 hours apart.

Figure S4. Average spike rates of the neurons used in the analyses from the three experiments. Reponses to the preferred stimulus are shown in blue and responses to the blank stimulus in red. To quantify whether there were significant changes in spike rate throughout the experiments, for each of the two stimulus conditions, a one-way ANOVA was performed for the different stimulus blocks. Spike rates did not change for any experiment ($P > 0.10$ for each stimulus condition in each experiment).

Figure S5. Spike-time correlation properties of all 1236 neuron pairs. ***A*:** When analyzed for all the neuron pairs, preferred stimulus CCH peak amplitudes were significantly greater than the blank (isoluminant gray screen) stimulus CCH amplitudes ($5.6 \times 10^{-3} \pm 0.9 \times 10^{-4}$ s^{-1} vs. $3.6 \times 10^{-3} \pm 0.5 \times 10^{-4}$ s^{-1}; mean ± SEM; $P < 10^{-23}$; Wilcoxon signed-rank test). The CCH amplitudes were, however, significantly correlated between the two conditions (Pearson correlation = 0.449; regression slope = 0.214; 95% confidence interval = ± 0.012; $R^2 = 0.202$; F = 313.4; $P < 10^{-23}$). ***B*:** CCH amplitudes were not significantly correlated with difference in orientation preference for the preferred (regression slope = 1.0×10^{-5}; 95% confidence interval = $\pm 0.6 \times 10^{-5}$; R^2 =

0.451; F = 3.29; $P > 0.20$) or the blank stimulus (regression slope = 1.0 X 10^{-5}; 95% confidence interval = ± 0.3 X 10^{-5}; $R^2 = 0.708$; F = 9.7; $P > 0.05$).

Figure S6. Correlation of shuffle-corrected CCHs for preferred stimulus and blank isoluminant conditions (N=279). ***A*:** CCH peak amplitudes (determined from the Gaussian fits for the CCHs) were strongly correlated for both conditions (Pearson correlation = 0.712; regression slope = 1.211; 95% confidence interval = ± 0.141; R^2 = 0.508; F = 285.5; $P < 10^{-23}$). ***B*:** The lags of these CCH peaks also were strongly correlated (Pearson correlation = 0.622; regression slope = 0.620; 95% confidence interval = ± 0.093; $R^2 = 0.386$; F = 174.4; $P < 10^{-23}$). ***C*:** The same was observed for the widths of the CCHs (Pearson correlation = 0.684; regression slope = 0.766; 95% confidence interval = ± 0.093; $R^2 = 0.467$; F = 243.1; $P < 10^{-23}$). See text for details.

Figure S7. Relationship of spike-time correlations between blank isoluminant stimulus and dark (eyes covered) conditions. ***A*:** A strong correlation was observed for the CCH peaks (N=157) for the two conditions (Pearson correlation = 0.747; regression slope = 0.866; 95% confidence interval = ± 0.122; $R^2 = 0.558$; F = 195.5; $P < 10^{-23}$). ***B*:** CCH peak lags were also strongly correlated (Pearson correlation = 0.684; regression slope = 0.718; 95% confidence interval = ± 0.109; $R^2 = 0.516$; F = 165.2; $P < 10^{-23}$). ***C*:** The widths of the CCHs were also similar (Pearson correlation = 0.779; regression slope = 0.799; 95% confidence interval = ± 0.108; $R^2 = 0.606$; F = 238.7; $P < 10^{-23}$). See text for details.

Figure S8. Relationship of spike-time correlations between preferred stimulus and dark conditions (N=161). ***A*:** A significant correlation was observed for the CCH peaks for the two conditions (Pearson correlation = 0.557; regression slope = 0.295; 95% confidence interval = ± 0.068; R^2 = 0.310; F = 69.6; $P < 10^{-23}$). ***B*:** CCH peak lags were also strongly correlated (Pearson correlation = 0.608; regression slope = 0.643; 95% confidence interval = ± 0.133; R^2 = 0.369; F = 90.7; $P < 10^{-23}$). ***C*:** In addition, the widths of the CCHs were similar (Pearson correlation = 0.584; regression slope = 0.664; 95% confidence interval = ± 0.146; R^2 = 0.342; F = 80.4; $P < 10^{-23}$). See text for details.