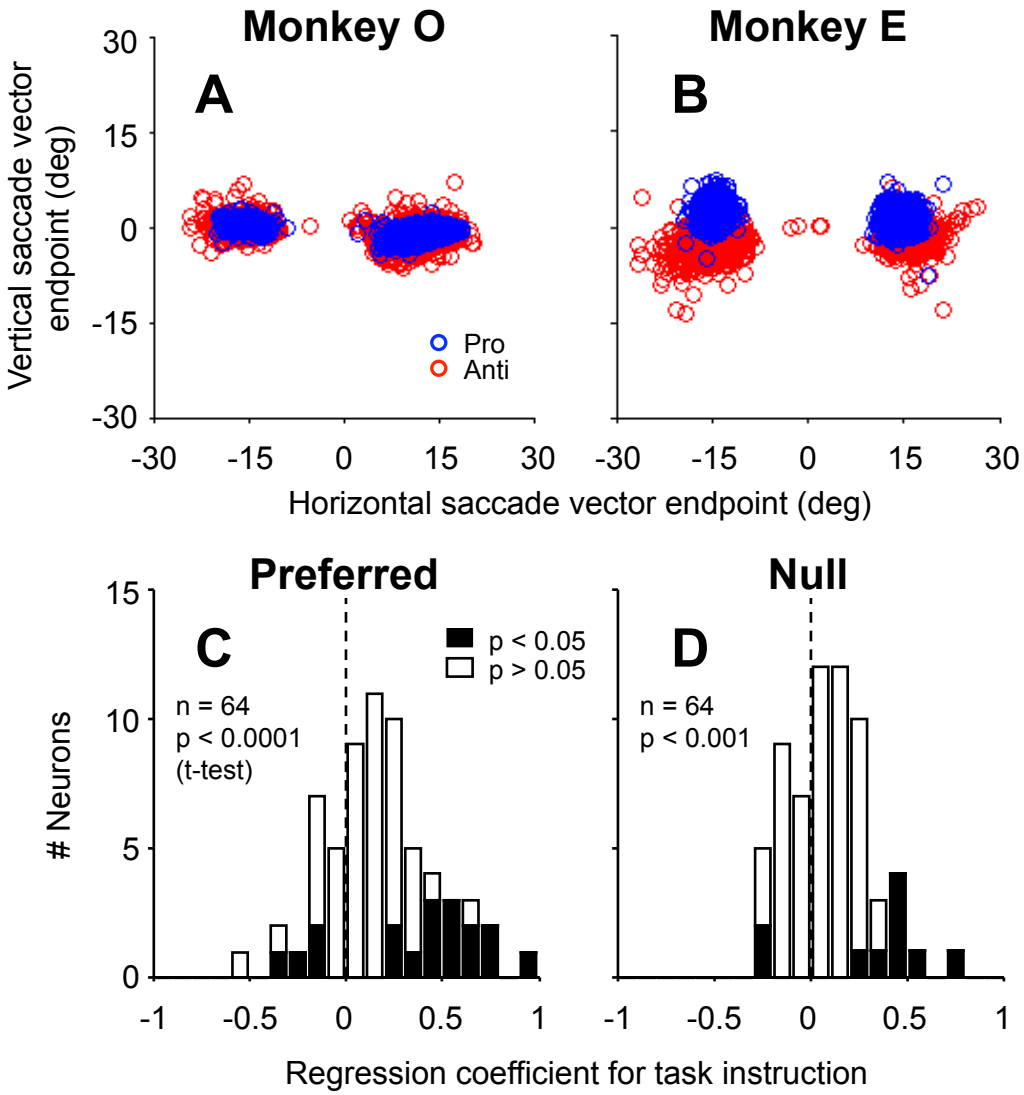
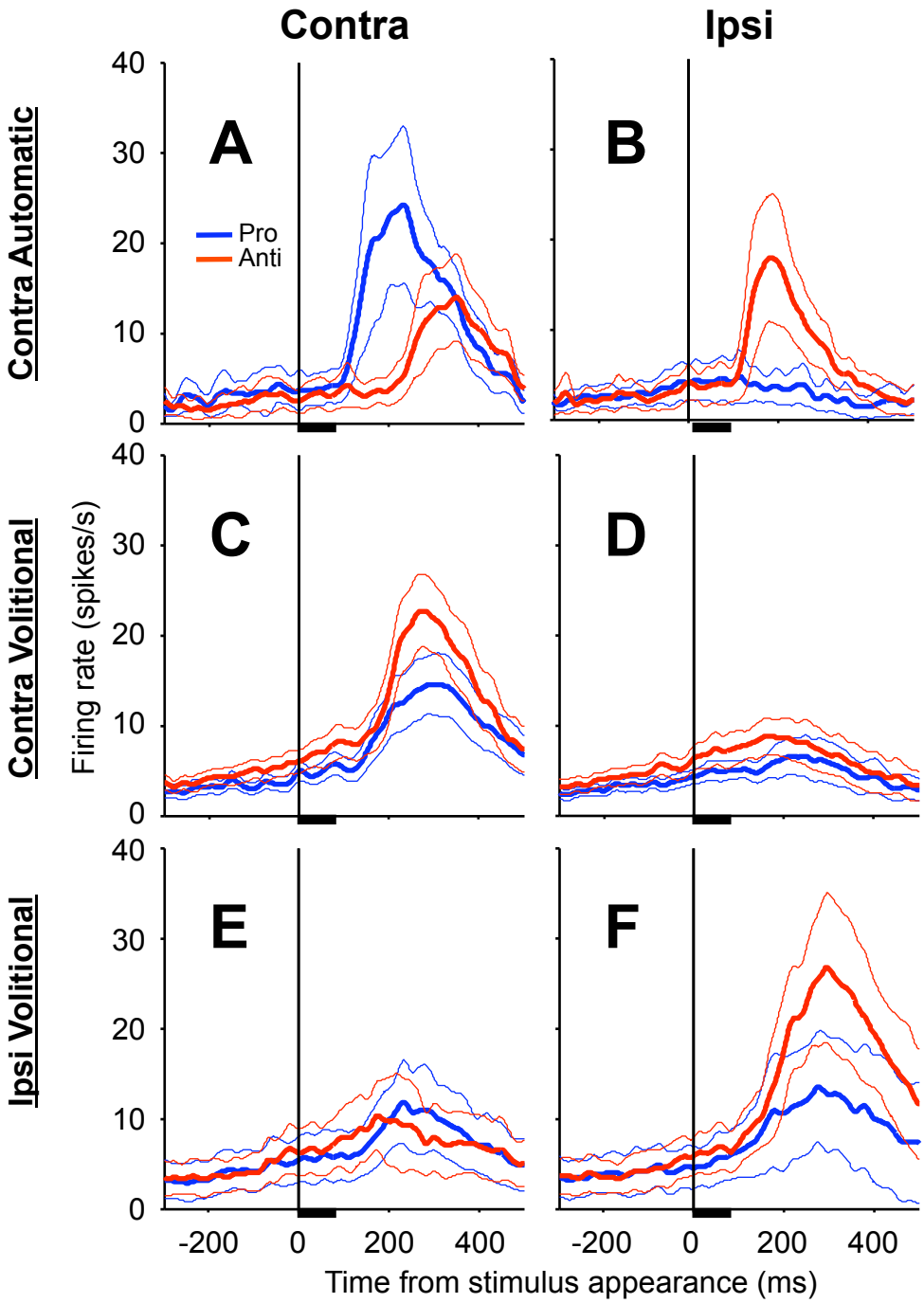
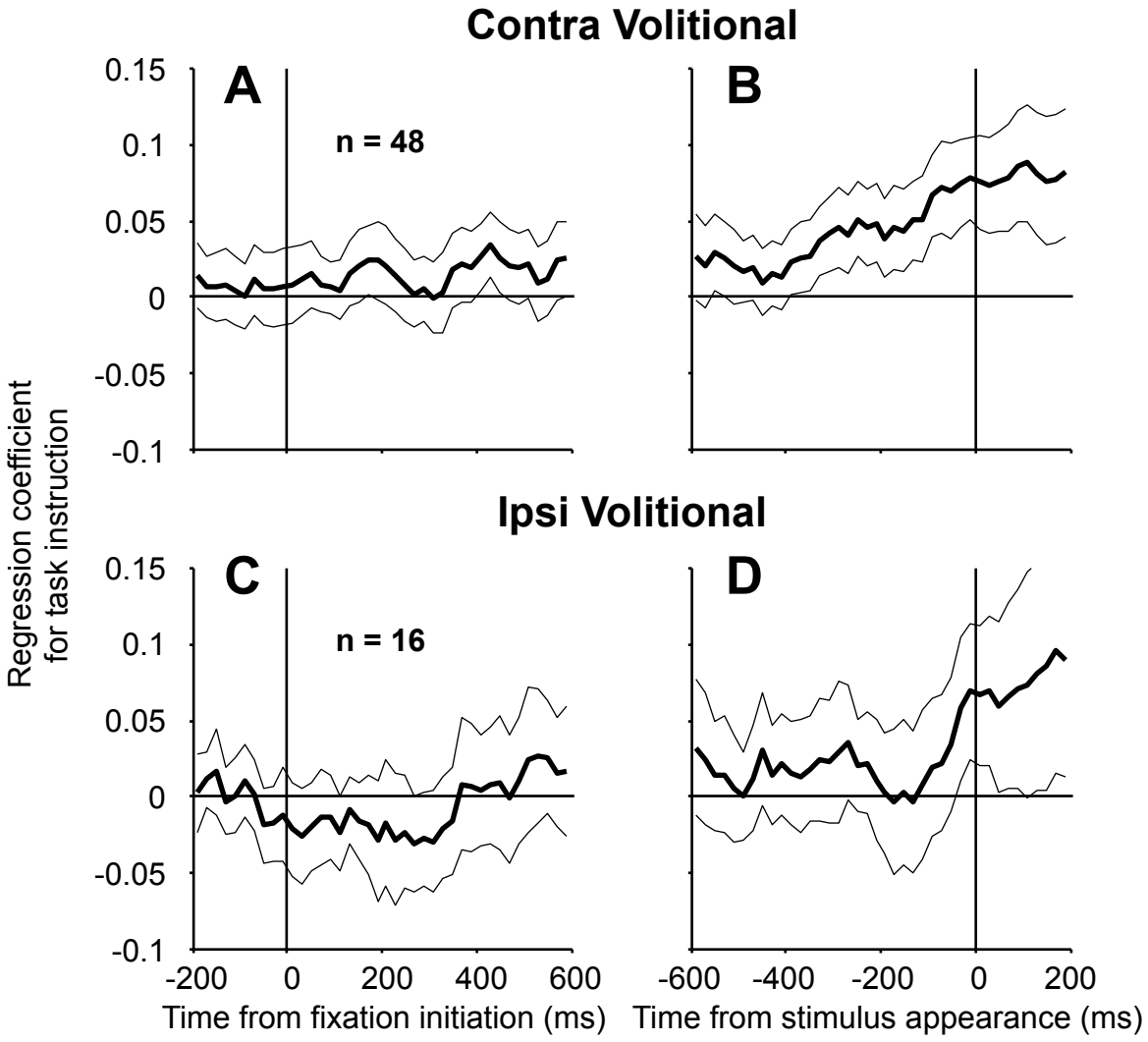


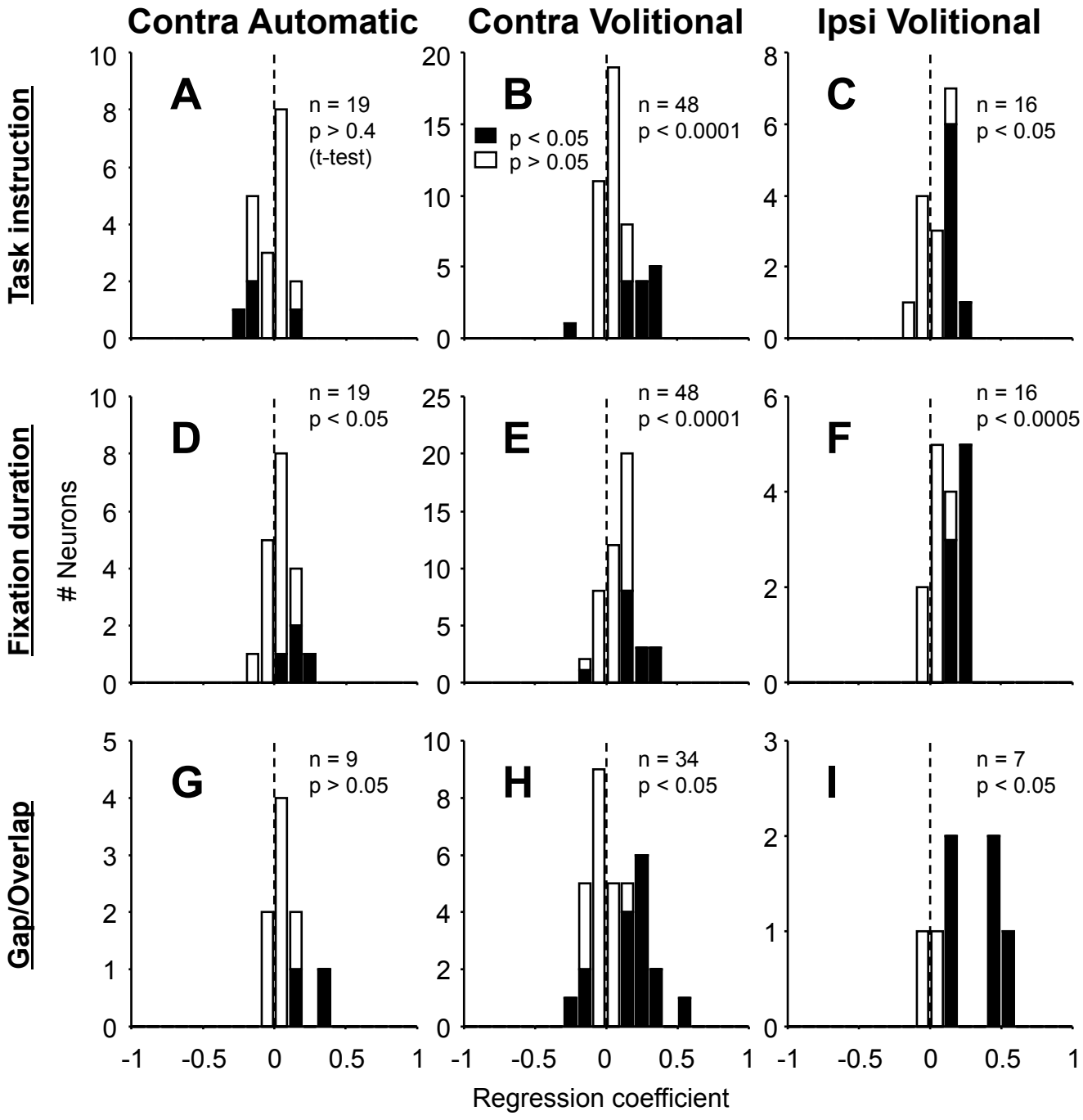
Supplementary Figure 1: Antisaccade instruction preferences of volitional neurons after saccade parameters were taken into account. (A, B) saccade vector endpoints in monkey O (A) and monkey E (B). Saccade initial points are aligned to the origin. (C, D) regression coefficients for task instruction when saccades were directed toward the preferred (C) and null (D) direction. In addition to saccade vector endpoints, peak velocities and durations were added to multiple linear regression analyses to calculate the regression coefficients for task instruction. The distributions of regression coefficients were biased toward positive values in both saccade directions, suggesting that the antisaccade instruction preferences of volitional neurons are not explained by differences in saccade parameters between pro- and antisaccades. Black bars indicate neurons with regression coefficients whose 95 % confidence interval did not include zero.



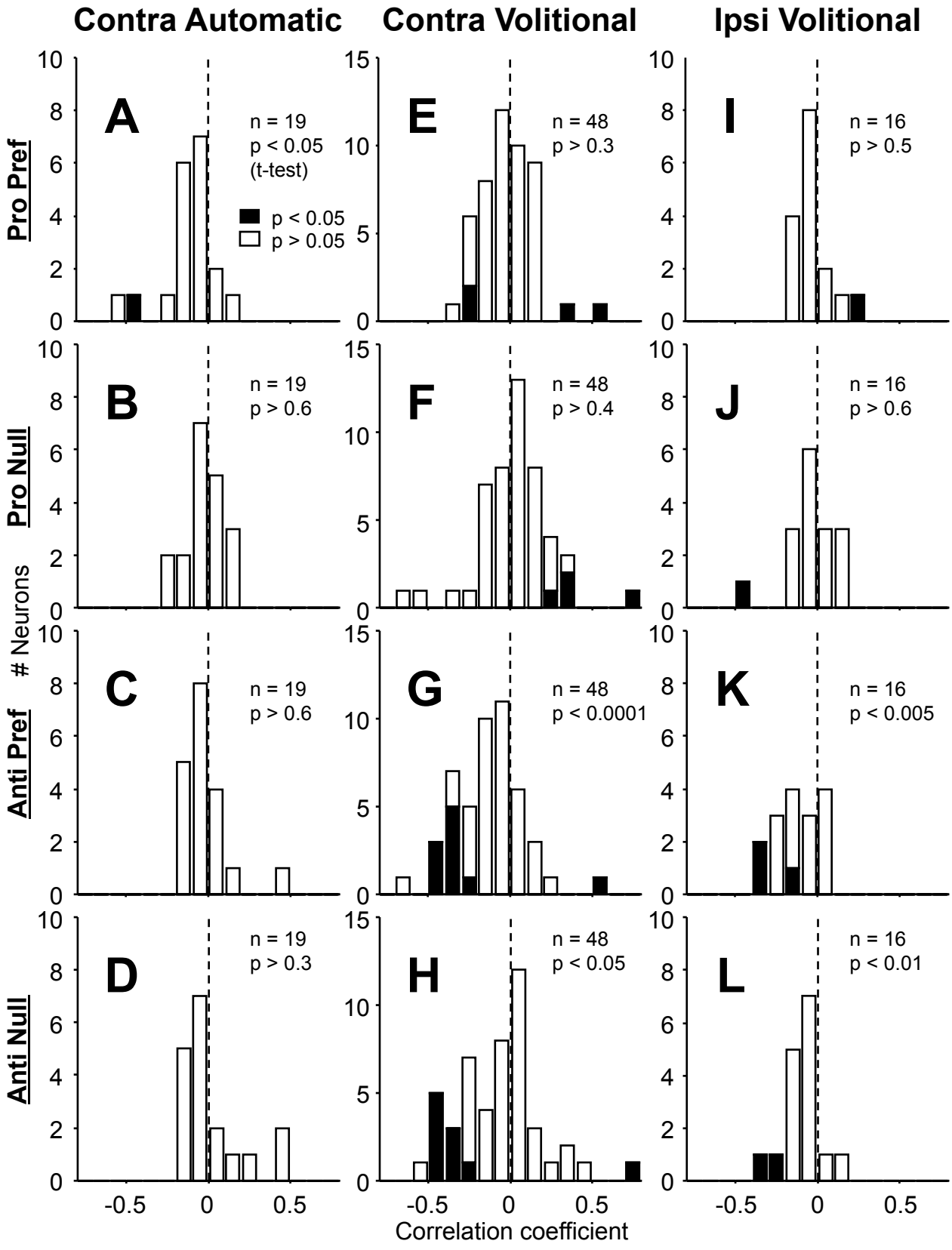
Supplementary Figure 2: population spike density functions aligned with stimulus appearance for neurons with different saccade direction preferences. (A, B) automatic neurons with contralateral saccade direction preferences. (C, D) volitional neurons with contralateral saccade direction preferences. (E, F) volitional neurons with ipsilateral saccade direction preferences. Thick lines indicate population averages. Thin lines indicate 95% confidence intervals. Black bars under x- axes indicate the pre-stimulus period (0-80 ms after stimulus appearance). Automatic neurons with ipsilateral saccade direction preferences are not shown here because they were rare (n = 4).



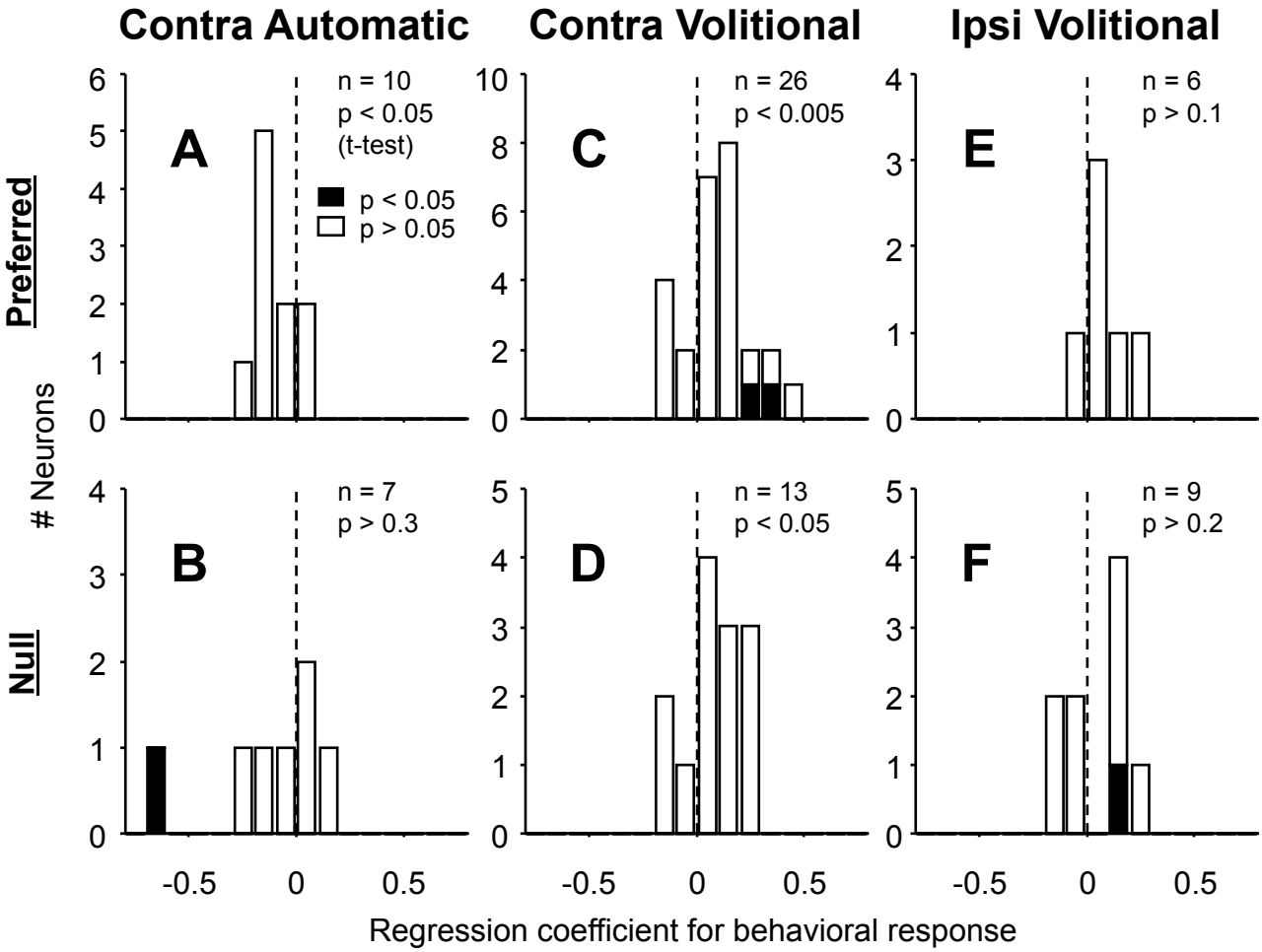
Supplementary Figure 3: Time course of antisaccade instruction preferences in volitional neurons with contralateral and ipsilateral saccade direction preferences. (A, B) contralateral saccade preferred volitional neurons. (C, D) ipsilateral saccade preferred volitional neurons. Left column (A, C) data aligned with fixation initiation. Right column (B, D) data aligned with stimulus appearance. Positive and negative values of regression coefficients for task instruction indicate antisaccade and prosaccade instruction preferences, respectively. Thick lines indicate population averages. Thin lines indicate 95% confidence intervals.



Supplementary Figure 4: Regression coefficients of neurons with different saccade direction preferences. Black bars indicate neurons with regression coefficients whose 95 % confidence interval did not include zero. In panel (G), the statistical test did not reach the significant level slightly (t-test: df = 8, t = 2.2, p = 0.059). Automatic neurons with ipsilateral saccade direction preferences are not shown here because they were rare (n = 4).



Supplementary Figure 5: Correlation coefficients between reaction times and pre-stimulus activity of neurons with different saccade direction preferences. Black bars indicate neurons with statistical significance (Pearson's correlation, $p < 0.05$). See Fig. 8 for details. Automatic neurons with ipsilateral saccade direction preferences are not shown here because they were rare (n = 4).



Supplementary Figure 6: Regression coefficients for behavioral responses (correct/direction error) in neurons with different saccade direction preferences. The numbers of neurons from monkey O are the followings. (A) 9, (B) 6, (C) 23, (D) 13, (E) 5, (F) 8. Black bars indicate neurons with regression coefficients whose 95 % confidence interval did not include zero. The positive biases of regression coefficients were confirmed in volitional neurons with contralateral saccade direction preferences (C, D). Statistical tests did not reach the significant level in volitional neurons with ipsilateral saccade direction preferences (E, F). The regression coefficients of automatic neurons with contralateral saccade direction preferences were biased toward negative values when correct antisaccades were required toward their preferred (contralateral) direction (A). We do not have clear explanation for this. Automatic neurons with ipsilateral saccade direction preferences are not shown here because they were rare (n = 4).