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Supplemental Data

Cholinergic Enhancement Reduces Spatial Spread of Visual Responses in Human Early Visual Cortex

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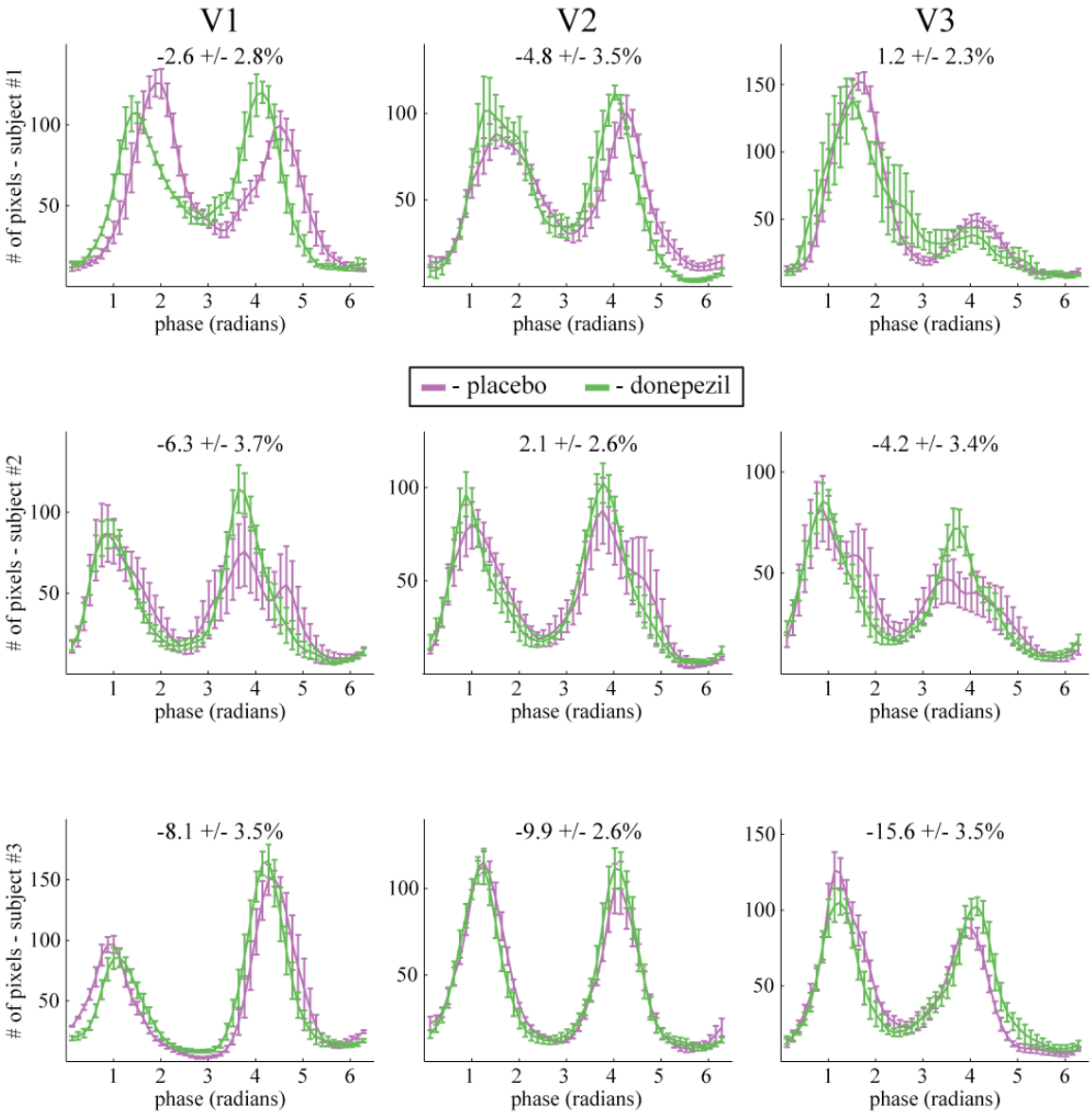
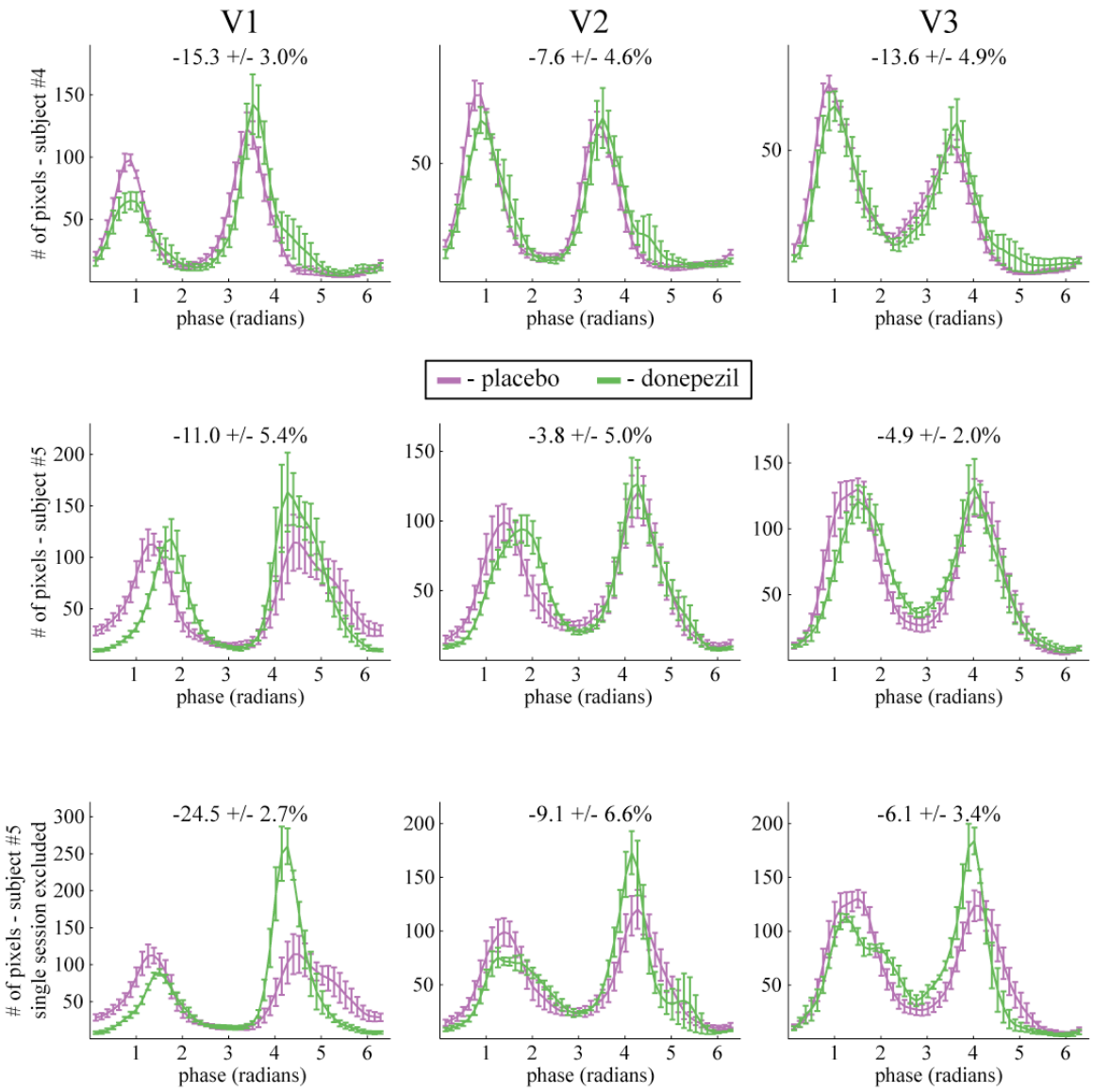
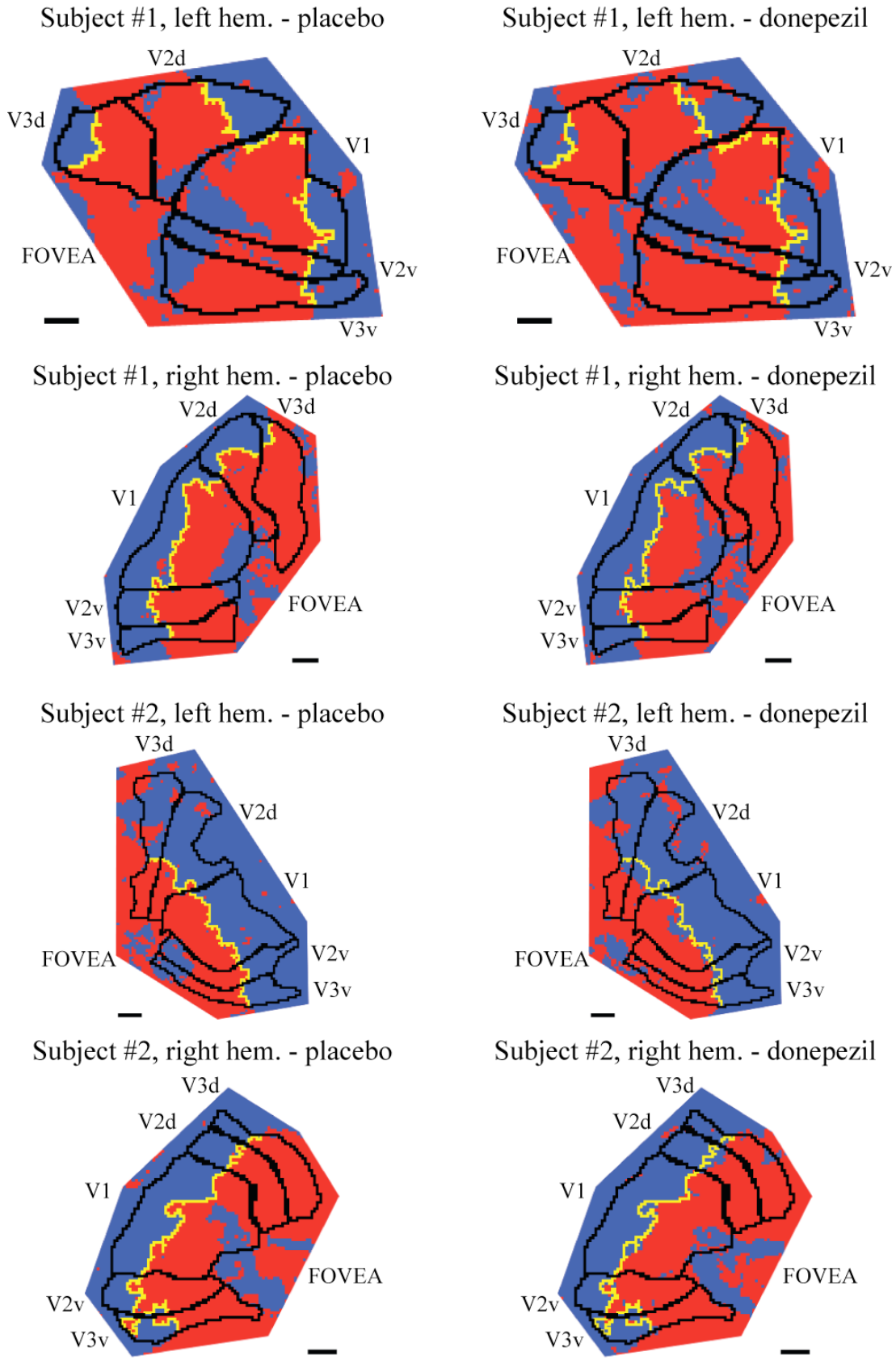


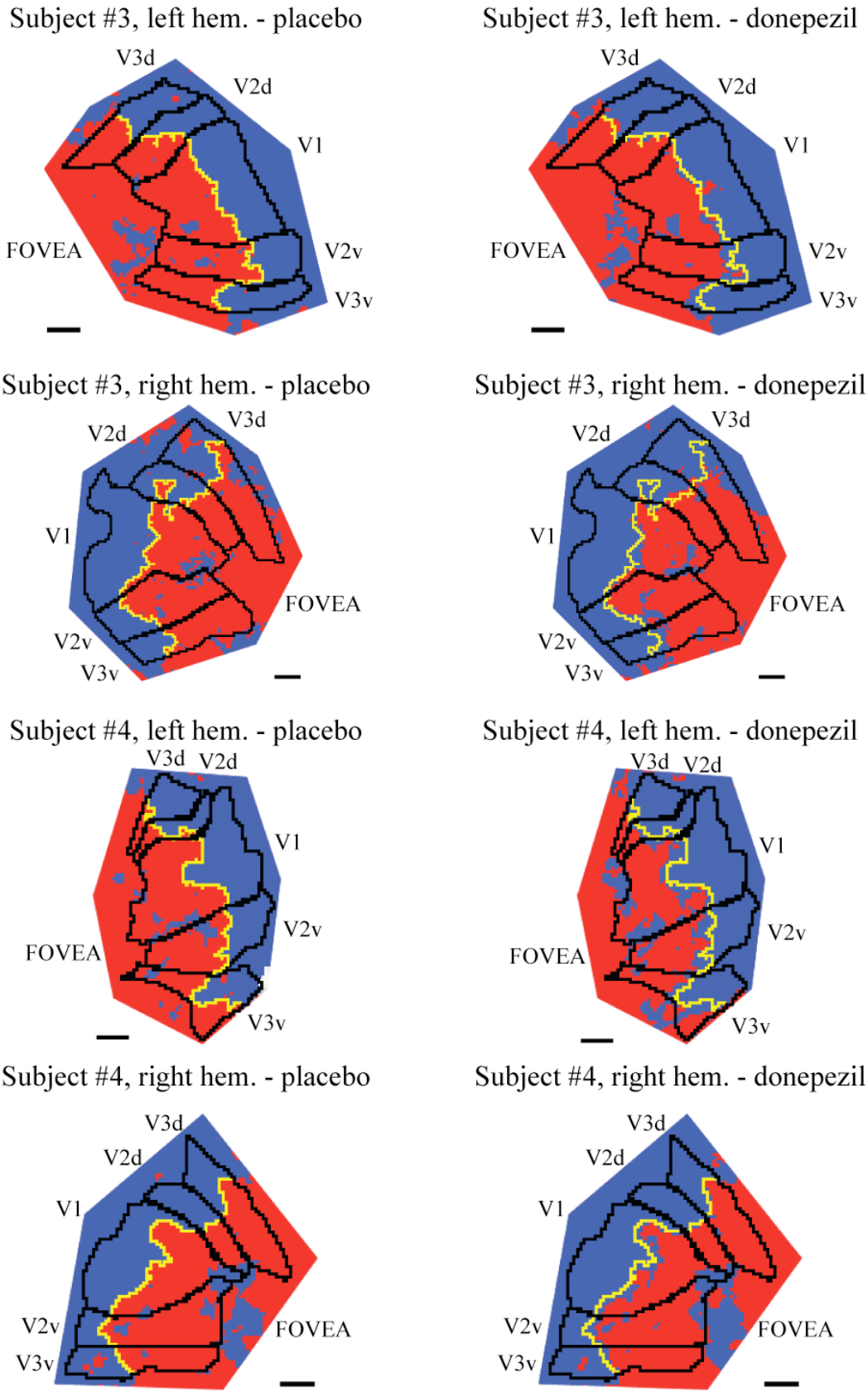
Supplementary Figure 1, first of two pages. **Mean pixel histograms for all subjects and all visual areas.** Each panel contains a pair of mean pixel histograms, one for placebo (purple) and one for donepezil (green). A pixel histogram was computed for each 5-minute fMRI run for each hemisphere and each visual area, and these histograms were averaged to generate the mean histograms shown here. Error bars indicate the standard errors of the mean of the pixel counts for each bin of the mean histogram. As in Figure 1B, the histograms all have a bimodal distribution, with the first peak corresponding to pixels with a positive BOLD response to the stimulus and the second peak corresponding to pixels with a negative BOLD response. The exact phase windows defining the positive and negative BOLD regions are not shown, as these phase windows were computed separately for each individual fMRI run. The numbers above each histogram show the average effect of donepezil on the fraction of positive BOLD pixels in each visual area, as displayed in Figure 4. The last row of histograms indicates the results from Subject #5 when a single aberrant fMRI session was excluded (see text for details).



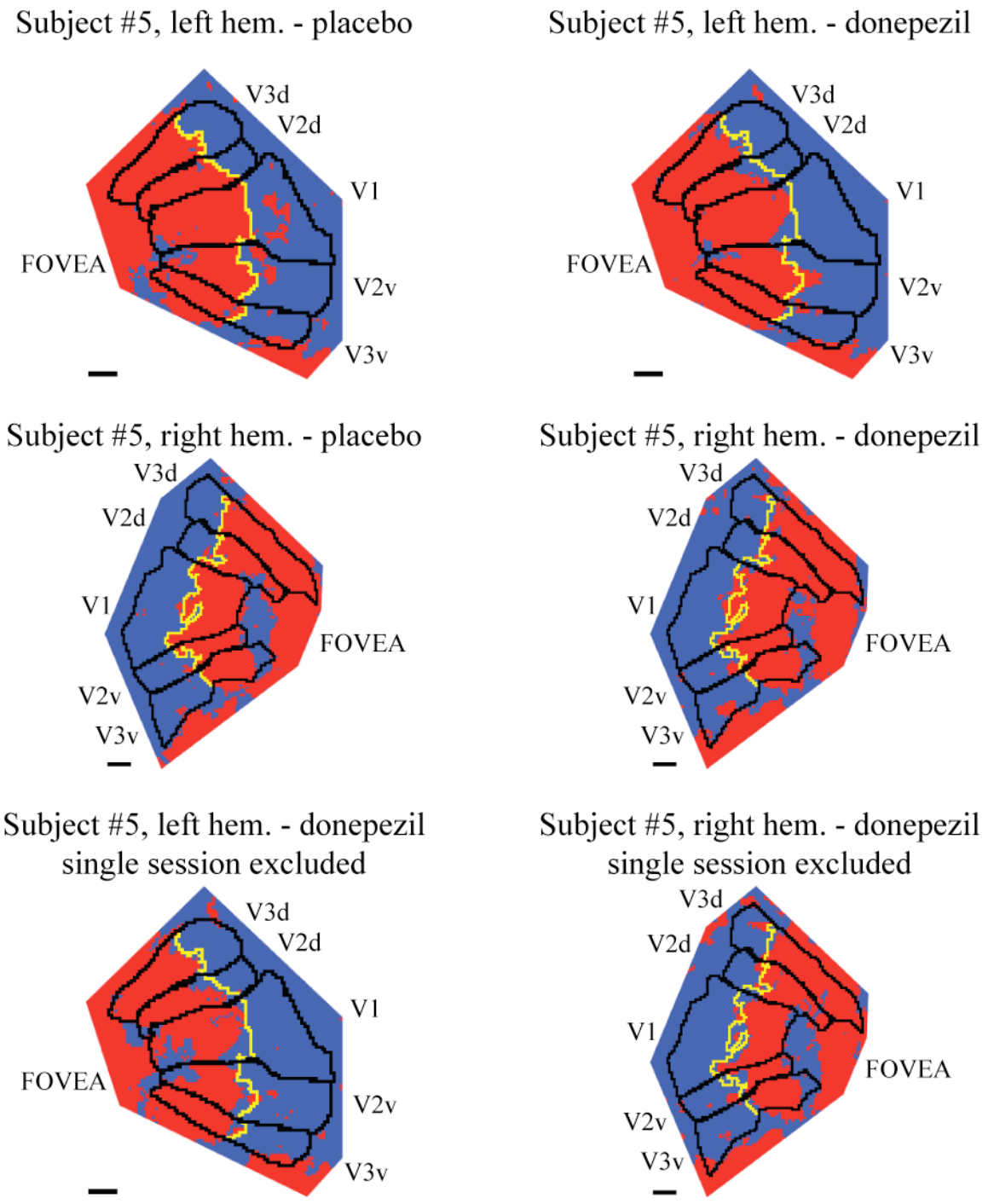
Supplementary Figure 1, second of two pages.



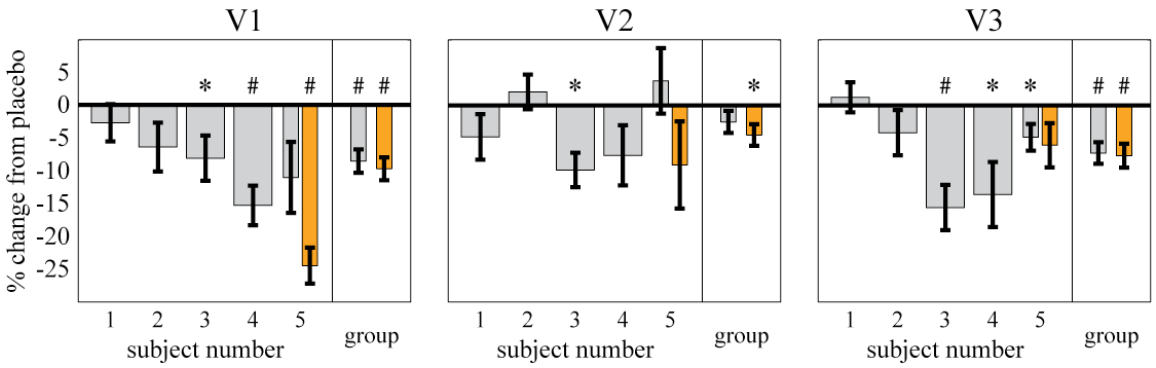
Supplementary Figure 2, first of three pages. See page 5 for figure legend.



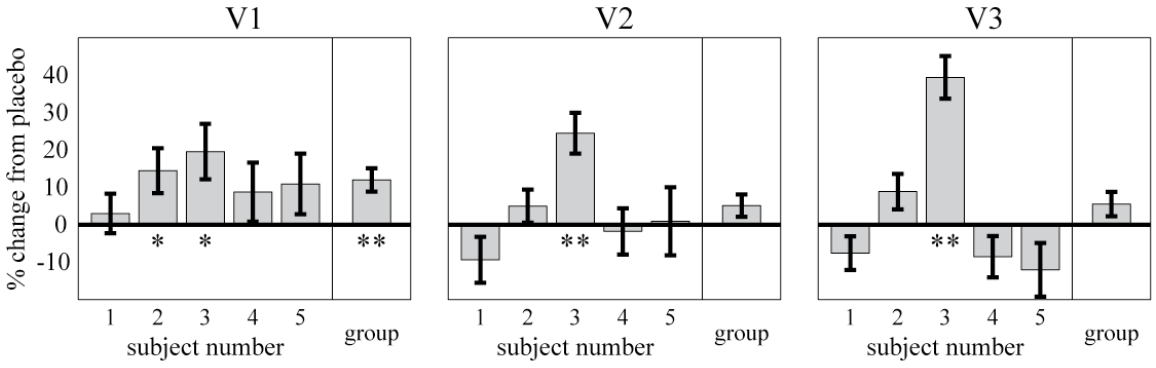
Supplementary Figure 2, second of three pages. See page 5 for figure legend.



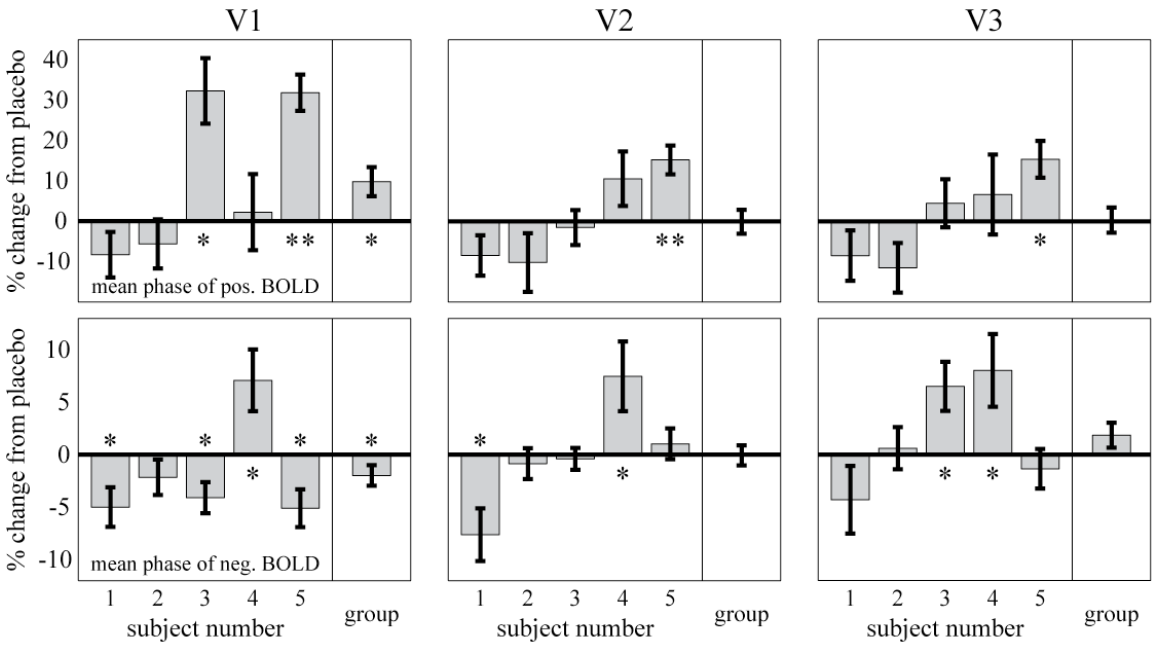
Supplementary Figure 2, third of three pages. **Binarized cortical flat maps for both hemispheres of all subjects.** Plotting conventions are the same as in Figure 3. *Red*, pixels with a positive BOLD response to the stimulus. *Blue*, pixels with a negative BOLD response. *Yellow*, boundary between the positive and negative BOLD regions, drawn based on the placebo condition. The final pair of flat maps indicates the distribution of response phases from Subject #5 when a single aberrant fMRI session was excluded (see text for details). *Scale bars*, 1 cm.



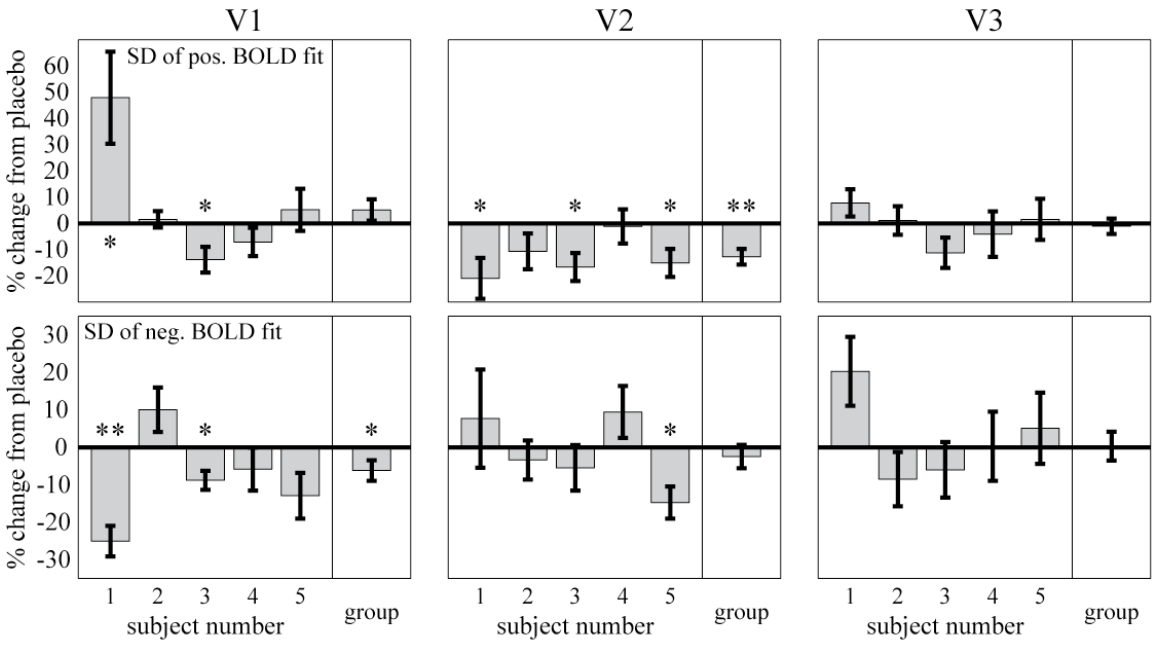
Supplementary Figure 3. **Exclusion of a single aberrant fMRI session substantially reduced variability in the effects of donepezil across early visual cortical areas.** Gray bars are identical to those plotted in Figure 4. Orange bars indicate results from the same analysis following exclusion of a single fMRI session from Subject #5 (see text for details). Exclusion of this aberrant session results in all three visual areas having a statistically significant reduction in spatial spread of excitatory visual responses following donepezil administration. Error bars are standard errors of the mean. *, $p < 0.05$; #, $p < 0.001$.



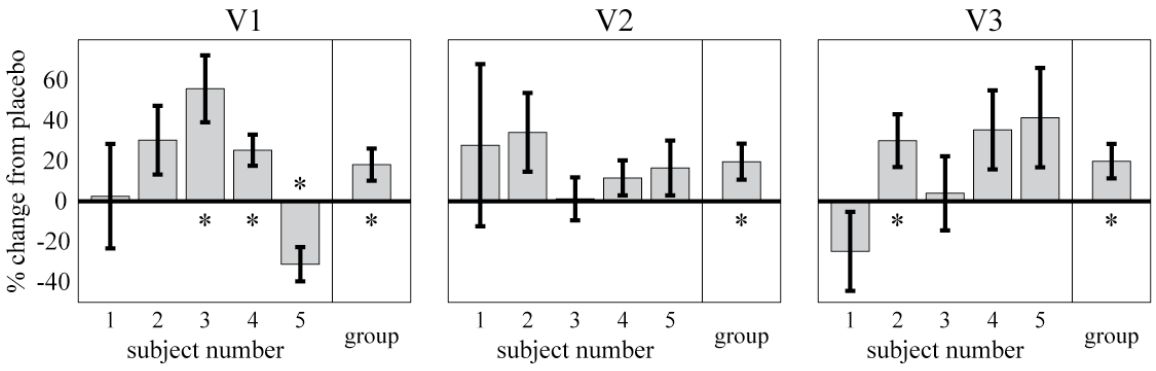
Supplementary Figure 4. **Effects of donepezil on the amplitude of negative BOLD responses in early visual cortex.** Conventions are identical to those in Figure 4. Donepezil increased the amplitude of the negative BOLD response in cortical area V1. Error bars are standard errors of the mean. *, $p < 0.05$; **, $p < 0.001$.



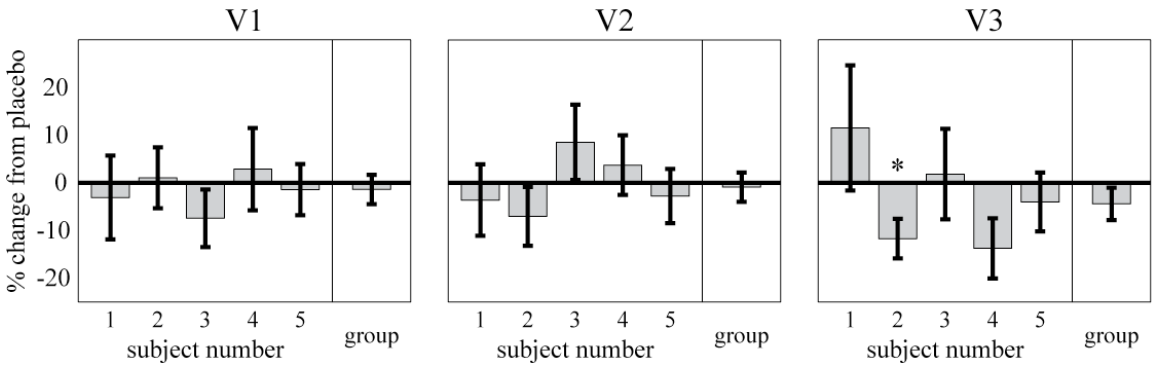
Supplementary Figure 5. **Effects of donepezil on the mean phases of the positive or negative BOLD response.** The means of the Gaussian fits of the pixel phase histogram corresponding to the positive BOLD (top panels) and negative BOLD (bottom panels) responses were computed for each run. These measures were compared for placebo and donepezil runs. Error bars are standard errors of the mean. *, $p < 0.05$; **, $p < 0.001$.



Supplementary Figure 6. **Effects of donepezil on the standard deviations of the Gaussian fits of the positive and negative BOLD responses.** The standard deviations (widths) of the Gaussian fits of the pixel phase histogram corresponding to the positive BOLD (top panels) and negative BOLD (bottom panels) responses were computed for each run. These measures were compared for placebo and donepezil runs. Error bars are standard errors of the mean. *, $p < 0.05$; **, $p < 0.001$.



Supplementary Figure 7. **Donepezil increased the amplitude of the y-offset term of the two-Gaussian fit of the BOLD responses.** The y-offset term of the two-Gaussian fit of the pixel phase histogram was computed for each run. This term is constant across all response phases for a given run and is an estimate of the proportion of pixels in a given area that do not clearly fit the bimodal distribution. This measure was compared for placebo and donepezil runs. Error bars are standard errors of the mean. *, $p < 0.05$.



Supplementary Figure 8. **Effects of donepezil on the mean squared error of the two-Gaussian fit of the BOLD responses.** The mean squared error (MSE) of the two-Gaussian fit of the pixel phase histogram was computed for each run. This term is a measure of the goodness-of-fit of the two-Gaussian model. The two-Gaussian fitting procedure employed in this study minimized the MSE between the model and the observed time series for each run. MSE was compared for placebo and donepezil runs. Error bars are standard errors of the mean. *, $p < 0.05$.