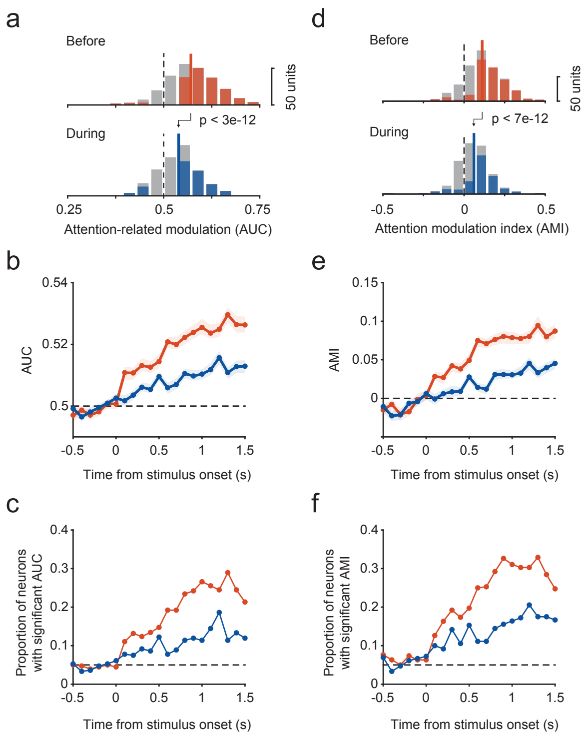
Supplementary figure 1



Supplementary figure 1. Effect of SC inactivation on attention-related modulation in fSTS is consistent across different methods of quantification (related to figure 2)

a. Distribution of area under the receiver operating characteristic curve (AUC) values quantifying attention-related modulation (see Methods) before (median = 0.57) and during SC inactivation (median = 0.54) (Same as figure 2c). Solid and dotted lines indicate median and no modulation, respectively. Colored shading indicates significance for individual neurons ($p < 0.05$, bootstrap test).

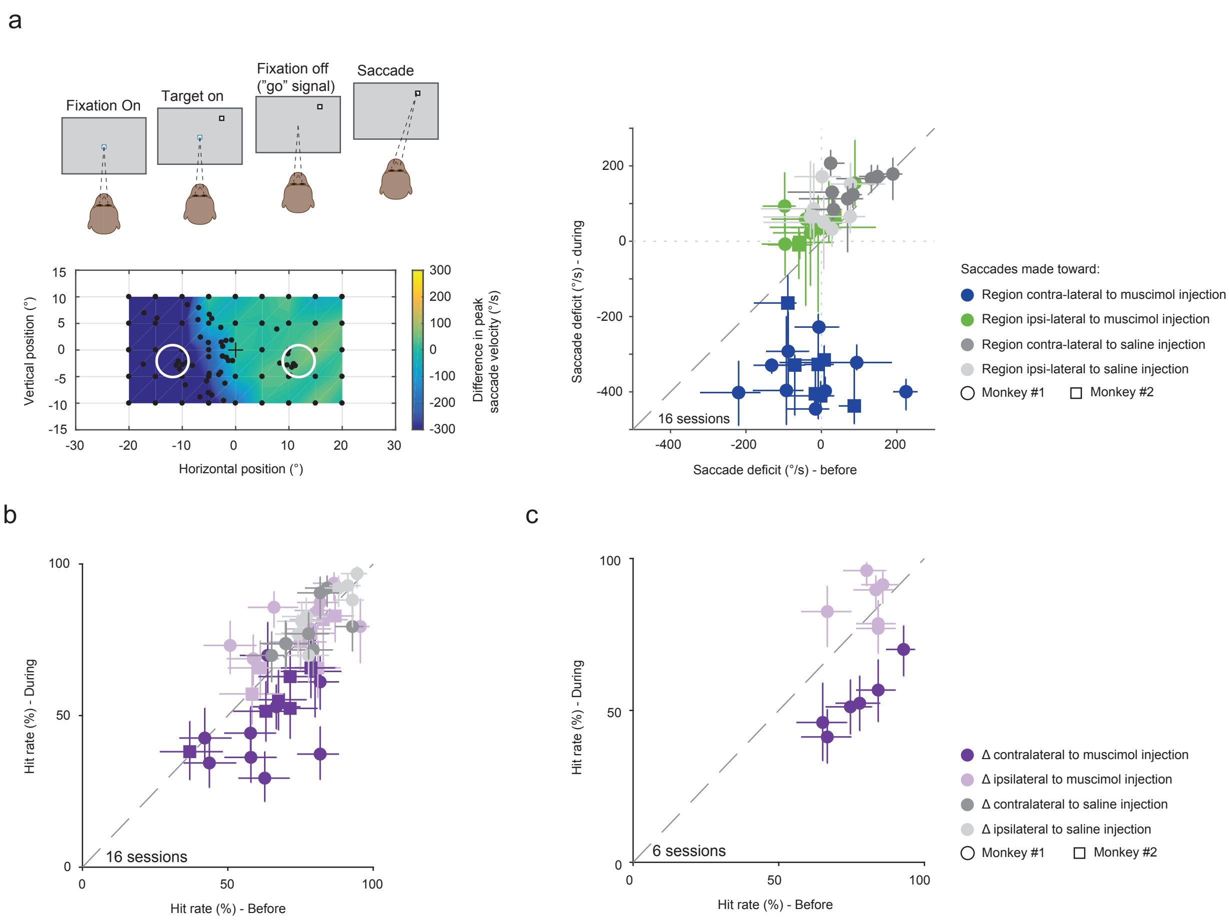
b. Time course of AUC values quantifying attention-related modulation in 0.1 s non-overlapping bins relative to stimulus onset, for fSTS neurons recorded before SC inactivation (red) and during (blue). Dashed line represents no modulation.

c. Time course reflecting the proportion of units exhibiting a statistically significant AUC value ($p < 0.05$, bootstrap test) in 0.1 s non-overlapping time bins relative to stimulus onset, for fSTS neurons recorded before SC inactivation (red) and during (blue). Dashed line represents chance.

d. Distribution of attention modulation index (AMI) values quantifying attention-related modulation (see Methods) before (median = 0.11, corresponding to an average response increase of 24.7% in the *Attend* condition compared to the *Ignore*) and during SC inactivation (median = 0.06, corresponding to an average response increase of 12.7% in the *Attend* condition compared to the *Ignore*). Same format as a.

e-f. Same as in b-c, but for AMI.

Supplementary figure 2



Supplementary figure 2. SC inactivation causes behavioral deficits in a visually guided saccade task and the selective attention tasks (related to figures 2 and 5)

a. Visually guided saccade task. Top: Sequence of events in the visually guided saccade task. Following fixation of a central spot, a saccade target was presented at a visual field location. The subject is rewarded for successfully making a saccade to the target upon fixation offset (see methods).

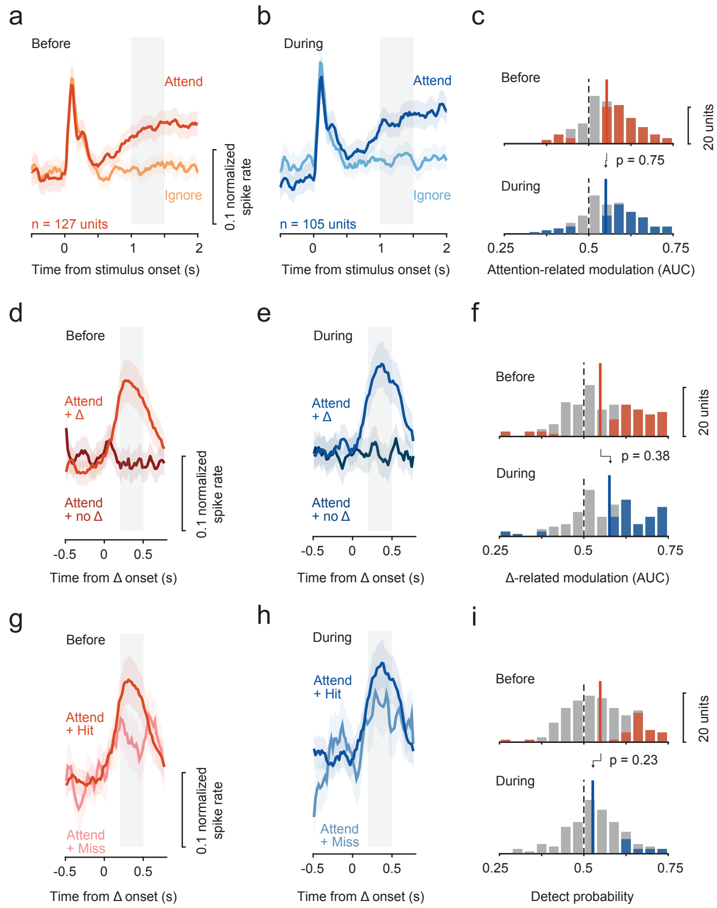
Bottom: A visual field map of saccadic deficit induced by SC inactivation in an example session. The difference between during and before SC inactivation saccade peak velocities is plotted for a large number of sampled targets in space. White circles represent the location of the motion stimulus used in the attention task that followed the visually guided saccade task.

Right: Summary of saccade deficit in the contralateral and ipsilateral stimulus locations (white circles in b) before and during injection for muscimol (SC inactivation) and saline injection sessions. Error bars represent 95% confidence intervals.

b. Behavior in the motion direction change detection task: The successful detection of a change (Δ) in motion direction (hit rate) in the *Attend* condition before SC inactivation vs. during, for when the change occurred in either the contralateral or ipsilateral stimulus, across all muscimol and saline injection sessions. Error bars represent 95% confidence intervals. The percentage of hits in the contralateral (affected) visual hemifield was significantly reduced during SC inactivation compared to performance in the ipsilateral (unaffected) visual hemifield (Wilcoxon signed-rank test, $p < 5e-04$) and to performance in the contralateral hemifield before inactivation (Wilcoxon signed-rank test, $p < 0.002$).

c. Behavior in the 2nd order orientation pulse detection task: Same format as in a, but for the 2nd order orientation pulse stimulus (see main figure 5 for associated neuronal responses). The percentage of hits in the contralateral (affected) visual hemifield was significantly reduced during SC inactivation compared to performance in the ipsilateral (unaffected) visual hemifield (Wilcoxon signed-rank test, $p < 0.04$) and to performance in the contralateral hemifield before inactivation (Wilcoxon signed-rank test, $p < 0.04$), consistent with previous reports (Bogadhi et al., 2019).

Supplementary figure 3



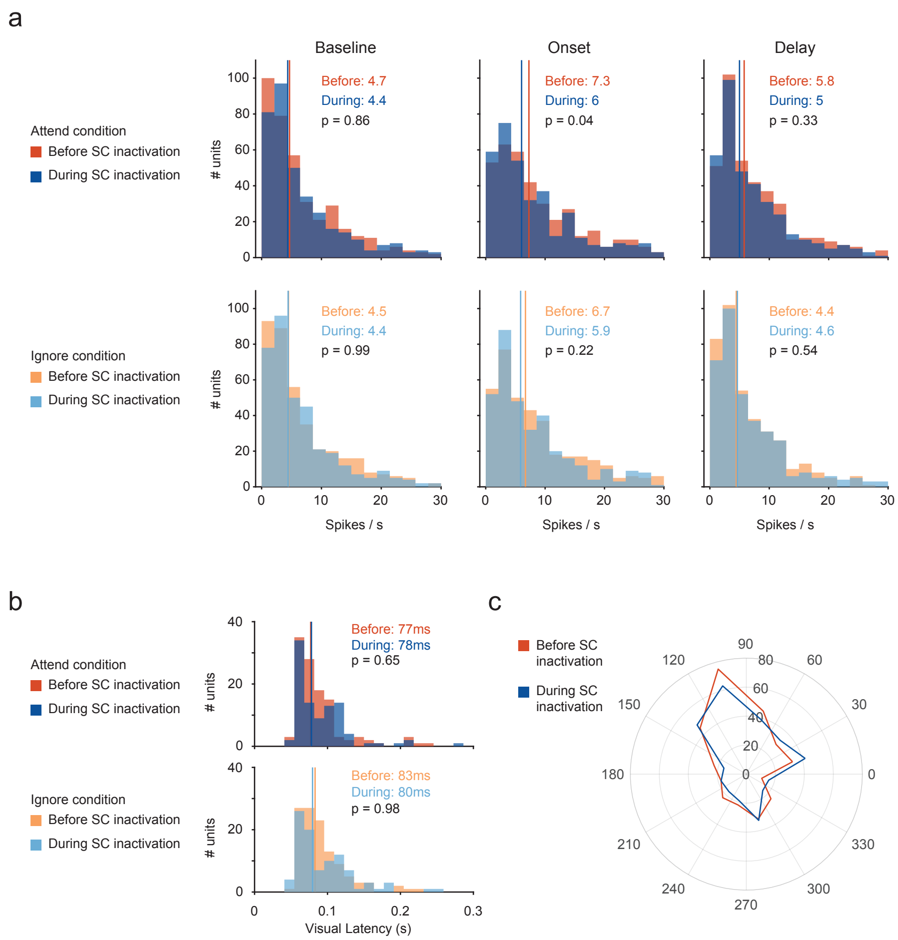
Supplementary figure 3. Saline and sham injections had no effect on attention-related modulation, change-related activity, or detect probability in fSTS (related to figures 2 – 4)

a-c. Attention-related modulation before and during saline/sham injections (same format as figure 2a-c).

d-f. Change (Δ) related activity before and during saline/sham injections (same format as figure 3a-c).

h-i. Detect probability before and during saline/sham injections (same format as figure 4a-c).

Supplementary figure 4



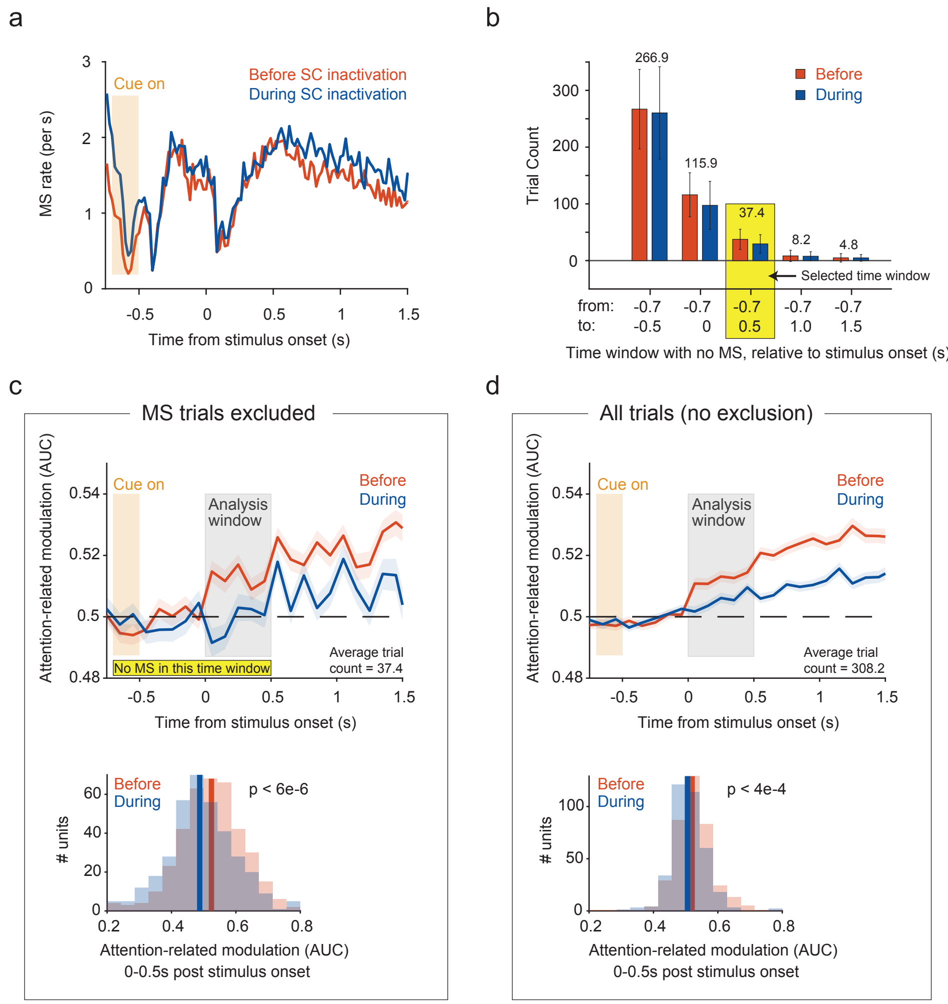
Supplementary figure 4. SC inactivation did not affect neuronal firing rate, visual response latency, and direction tuning (related to figure 2)

a. Spike rate was computed in three key epochs of *Attend* and *Ignore* conditions: baseline (0.12 - 0.8 s before stimulus onset); stimulus onset (0.8 - 0.12 s after stimulus onset); delay period (1 - 1.5 s after stimulus onset). The distributions of spike rates before and during SC inactivation are shown in the three epochs (up to 30 sp/s for visualization) of *Attend* (top) and *Ignore* (bottom) conditions. Median firing rate before and during SC inactivation, and associated p-values (Wilcoxon rank-sum test) are noted on individual panels.

b. Visual response latency (time from stimulus onset to neural response onset) was computed for each neuron in the *Attend* and *Ignore* conditions, before and during SC inactivation. Vertical lines reflect the distribution median. Median values and p-value comparing latencies before and during SC inactivation (Wilcoxon rank-sum test) are noted on individual panels. Response onset was determined from the mean peristimulus time histogram (PSTH) of each neuron. Baseline activity (-0.2 s to 0 s before stimulus onset) was used to obtain a baseline-mean and baseline-SD, and response onset was defined as the first of the 20 consecutive 1ms bins that were at least 4 baseline-SD above the baseline-mean.

c. Preferred direction of each neuron was obtained using the direction tuning task (see Methods). Histogram of preferred directions across the fSTS population of neurons, before and during SC inactivation, is plotted in polar coordinates. Radial measure represents number of neurons with the corresponding preferred direction.

Supplementary figure 5



Supplementary figure 5. Effect of SC inactivation on attention-related modulation in fSTS cannot be attributed to microsaccades (related to figure 2)

A recent study (Lowet et al., 2018) reported that attention-related modulation in visual cortex occurs only following a microsaccade (MS) in the direction of the cued location. To determine the influence MS might have had on our results, we detected all MS, using velocity (30 °/s) and acceleration threshold (400 °/s^2), during the full duration of a trial (amplitude: mean ± sd = 0.42° ± 0.2°) and excluded trials in which a MS occurred anywhere from cue onset to the end of the time window in which we measured attention-related modulation. We could not use the 1 - 1.5 s window for computing attention-related modulation (as in figure 2) because excluding trials with MS anywhere from cue onset until the end of this 1 - 1.5 s window resulted in too few trials per neuron to compute an AUC (mean ± sd = 4.83 ± 5.85; panel b). The earliest time window that could be used for this analysis while still yielding sufficient trials (mean ± sd = 37.4 ± 17.8; panel a) for statistical power was the 0 - 0.5 s window aligned to stimulus onset (grey window in panels c-d). Thus, we measured attention-related modulation in this 0 - 0.5 s window, on trials in which no

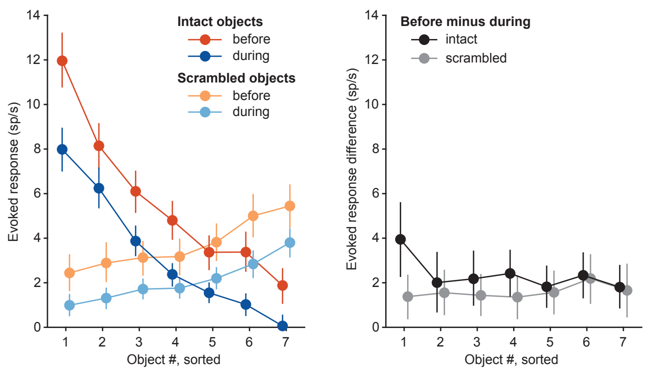
MS occurred from cue onset (i.e. 0.7 s before stimulus onset) until the end of the window (i.e. 0.5 s after stimulus onset), before and during SC inactivation. We show that the effect of SC inactivation on attention-related modulation in fSTS cannot be attributed to MS.

a. The average frequency of MS aligned to the stimulus onset in Attend condition is shown for before and during SC inactivation sessions. Consistent with previous findings (Rolfs et al., 2008), the plot shows the saccadic inhibition following visual events such as cue onset, cue offset and stimulus onset.

b. Average number of trials per neuron in the *Attend* and Ignore conditions, with no MS from cue onset (-0.7 s) to different time points in the trial (-0.5 s, 0 s, 0.5 s, 1 s, 1.5 s). The time window with at least 30 trials per neuron which overlaps with stimulus presentation in the attention task was chosen as the analysis window (panels c, d).

c, d. Top**:** Time-course of attention-related modulation before and during SC inactivation, computed on trials with no MS from cue onset to 0.5 s post stimulus onset (c) and on all trials (d). Even without MS from cue onset to 0.5 s post stimulus (panel c), the attention-related modulation is significant following stimulus onset, and is reduced during SC inactivation. Bottom: Distribution of attention-related modulation values before and during SC inactivation, computed in the 0 - 0.5 s time window (grey windows in top panels), on trials with no MS from cue onset to 0.5 s post stimulus onset (c) and on all trials (d). Solid lines indicate medians. The results in c demonstrate that even with no MS preceding or occurring within the first 500ms of stimulus presentation, neurons in fSTS show attention-related modulation that is dependent on SC activity.

Supplementary figure 6

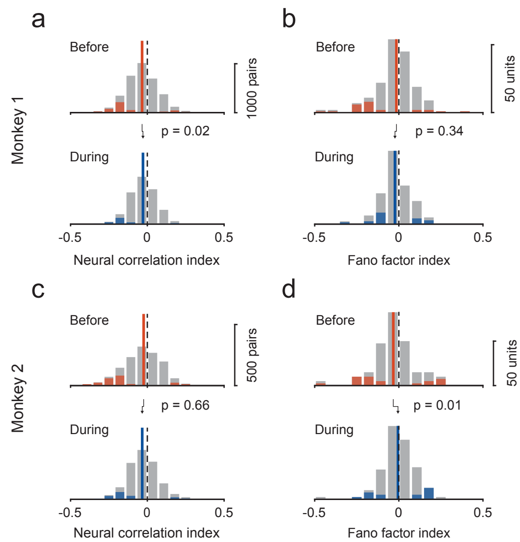


Supplementary figure 6. The effect of SC inactivation on object selectivity in fSTS is largely due to a reduction in sensory responsiveness (related to figure 6)

a. The evoked responses of fSTS neurons to objects were sorted by their preference to the objects before pooling across population. The average evoked responses of fSTS neurons (0.08 to 0.12 s post object stimulus onset minus baseline) are shown for each of the seven objects, in the order of their preference. For example, object #1 is the best preferred object as quantified by the AUC between response to the intact object vs. its corresponding scrambled. Similarly, Object #7 is the least preferred object. Data are presented for both intact and scrambled objects, before vs. during SC inactivation. Error bars are 1 SEM, bootstrapped. Slight horizontal offset of data points is for visualization.

b. The difference between average evoked responses of fSTS neurons before SC inactivation and during, for intact and scrambled objects. Error bars are 1 SEM, bootstrapped. Slight horizontal offset of data points is for visualization. The overall reduction in response across both intact and scrambled objects following SC inactivation indicates that the reduction in object selectivity is largely due to a reduction in sensory responsiveness of fSTS neurons. The reduction is larger for the preferred object over the remaining objects, suggesting a selective effect of SC inactivation on the preferred object, but this was not statistically significant ($p = 0.14$, 2-factor ANOVA on intact objects).

Supplementary figure 7



Supplementary figure 7. Effect of SC inactivation on spike count correlations and fano-factor in fSTS neurons (related to figure 2)

a. Distribution of neuronal correlation indices (see Methods) before (top) and during (bottom) SC inactivation, for monkey #1.

b. Distribution of neuronal fano-factor indices (see Methods) before (top) and during (bottom) SC inactivation, for monkey #1.

c. Same as a, for monkey #2.

d. Same as b, for monkey #2.