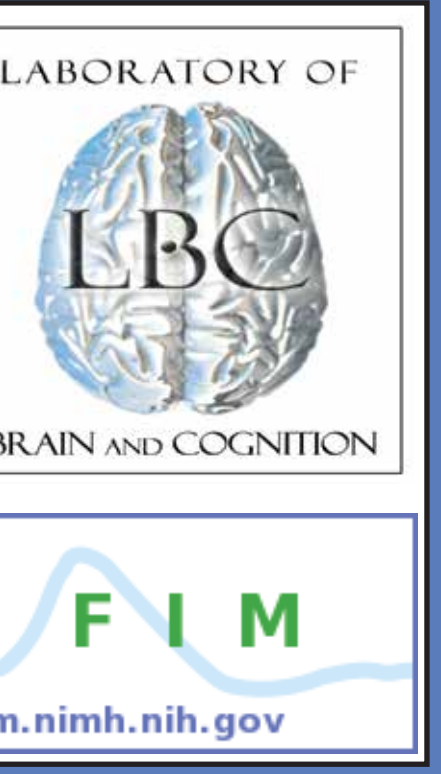


# Network changes in response to thetaburst TMS to the rpSTS

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Poster # 1054



## HYPOTHESIS

A perturbation in one region of a network of face-selective areas will specifically alter other regions in that network as observed with resting state fMRI.

## METHODS

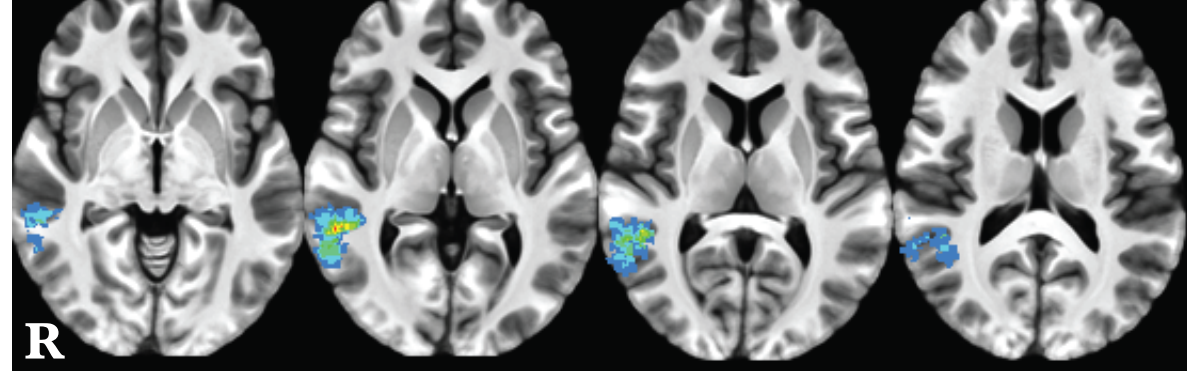
### Experimental Design

The brain is focally disrupted using thetaburst transcranial magnetic stimulation (TBS).

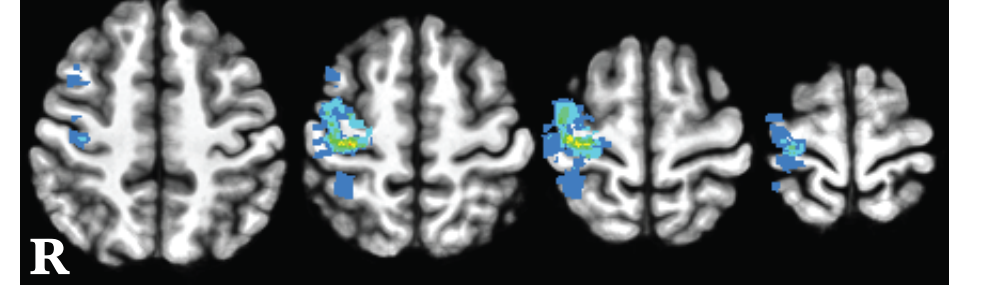
The right posterior superior temporal sulcus (rpSTS) is the target stimulation site in the face-selective network

The right hand knob in the motor cortex (rHK) is the active control stimulation site

Right Posterior Superior Temporal Sulcus (rpSTS)



Right hand motor cortex (rHK)



# Volunteers with each voxel in the ROI

The ROIs were individually localized for stimulation site selection, so there is spatial variability in the group maps

### Data were collected across 3 different days

Day 1: T1 weighted anatomical & functional localizer data to identify the stimulation sites:

Site 1: Peak voxel for faces > objects in the rpSTS

Site 2: Anatomically localized in the right hand knob

Days 2 & 3 (at least 1 week apart):

10-minute resting state fMRI run before and after targeted TBS to the rpSTS or rHK

Stimulation was outside the MRI and the post TBS resting state scan began 3-5 min after TBS ended

### Data Collection

17 volunteers; 11 Female

FMRI parameters: 3T MRI, GRE EPI, TR=2s, TE=14.8, 27.1, & 39.5ms

TBS delivered at 30% machine output

3 pulses at 50 Hz repeated every 200 ms for 60 sec

### Processing

fMRI data were processed in each subjects' space.

Alignment and motion correction were calculated on middle echo time series & applied to 3 echoes as single transform matrix

ME-ICA denoising removed non-BOLD-like components: bitbucket.org/BenGutierrez/me-ica

Anatomical scans were iteratively nonlinearly aligned to a common space (AFNI: @toMNI\_Qwarp).

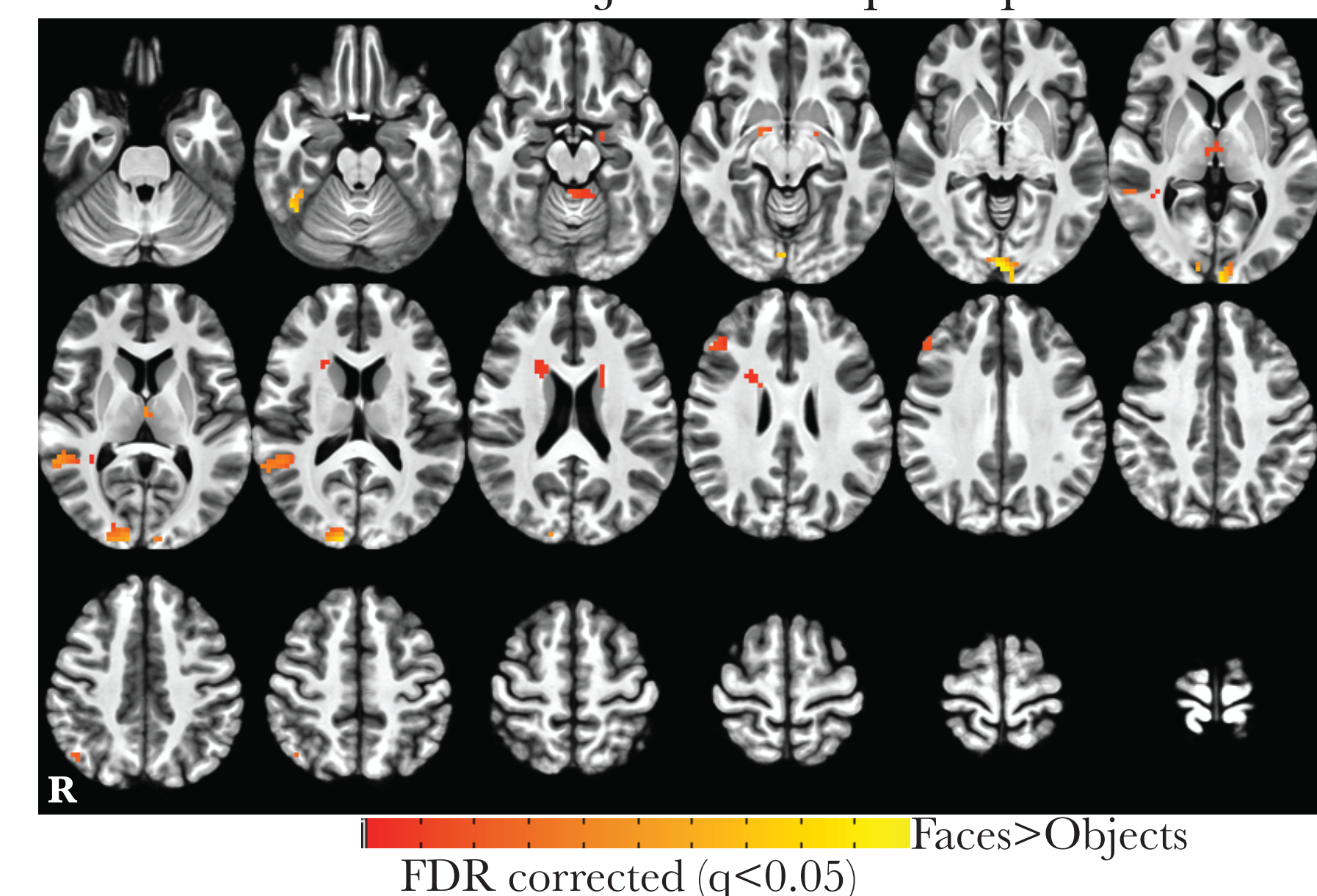
### Correlational Analyses

For the face network, the ROIs were the Fusiform Face Area (FFA), Amygdala, and Occipital Face Area (OFA). The ROIs were the intersection of an uncorrected  $p < 0.01$  Faces-Objects contrast and the fusiform gyrus, amygdala, and lateral occipital cortex masks defined within each subject using Freesurfer. These ROIs are part of a previously defined face network (Pitcher 2014). The ROIs for the motor cortex hand knobs (HK) were drawn by hand using anatomical landmarks.

Correlations were calculated for each 10 min run for each pair of ROIs and with whole brain correlations to the stimulation sites.

R-values were Fischer Z-transformed. For each pair of ROIs, group statistics were calculated using a linear mixed effects model with within-subjects factors for the two TBS stimulation sites and pre vs post stimulation scans. For the whole brain group analysis, the Fisher Z values were warped to a common space.

### Faces-Objects Group Map



## REFERENCES

Pitcher, D., Duchaine, B., Walsh, V., 2014. Combined TMS and fMRI Reveal Dissociable Cortical Pathways for Dynamic and Static Face Perception. *Current Biology* 24, 2066-2070.

Multi-echo fMRI references

Kundu, P. (2012). 'Differentiating BOLD and non-BOLD signals in fMRI time series using multi-echo EPI' *Neuroimage* vol. 60, pp. 1759-70

Posse, S. (1999). 'Enhancement of BOLD-contrast sensitivity by single-shot multi-echo functional MR imaging.' *Magnetic Resonance in Medicine* vol. 42, no. 1, pp. 87-97

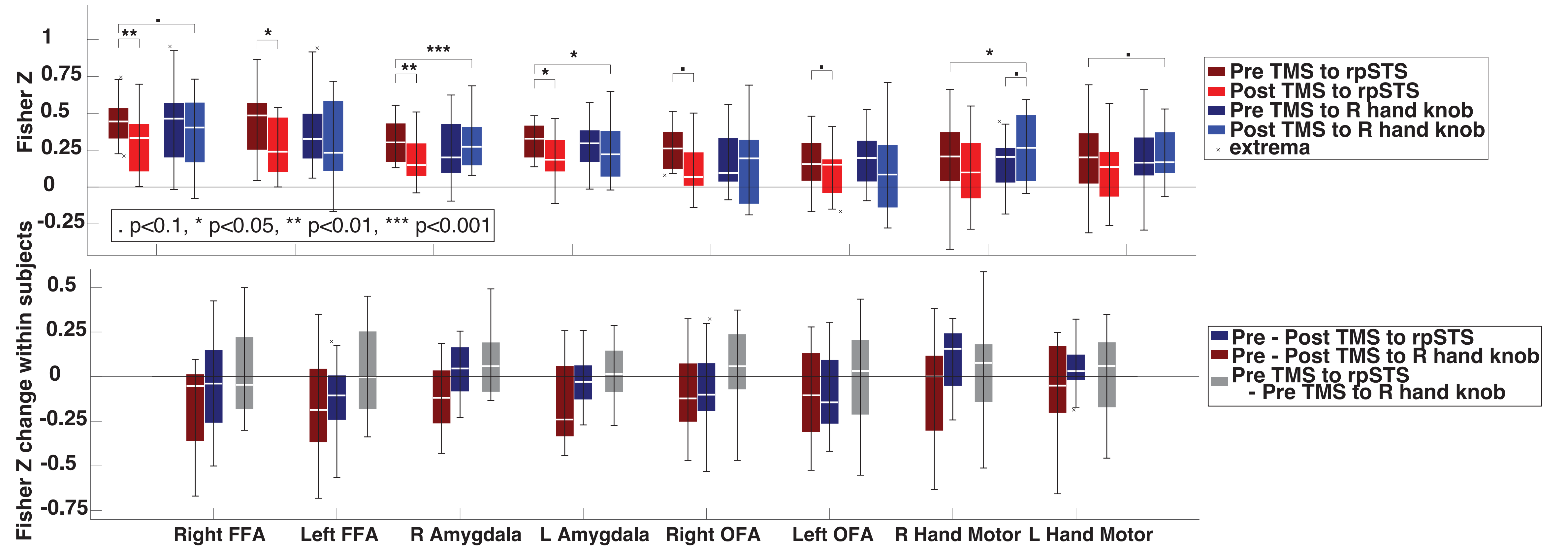
## ACKNOWLEDGEMENTS

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## RESULTS

### Correlations pre and post TBS to the right posterior superior temporal sulcus seed

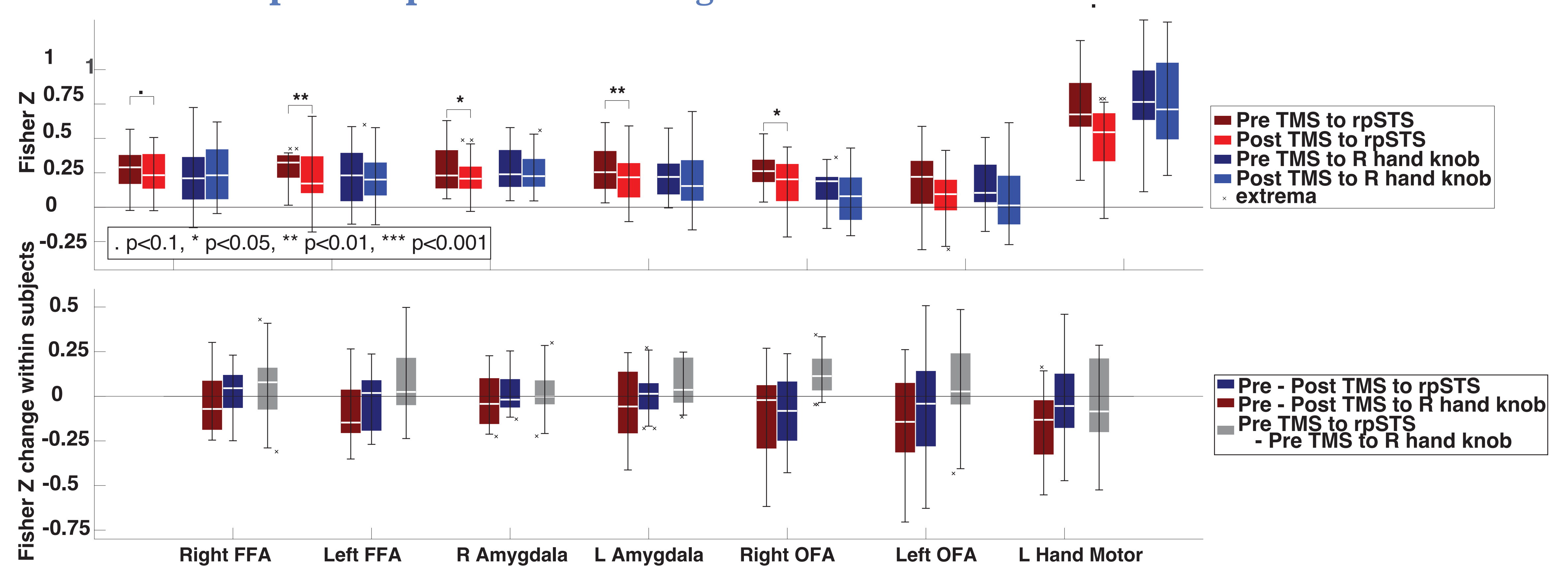


Boxplots show 25-75% of the distribution. The white line is the median. Whiskers are the maximum and minimum values excluding outliers. Significance statistics are from a 2-way ANOVA. The lower plot shows the within-subject mean differences for each stimulation site.

Correlations between the rpSTS and the other face selective regions consistently decrease after rpSTS stimulation, but not rHK stimulation.

While there is variance across individuals, these plots highlight that most subjects showed a correlation decrease after TBS to the rpSTS

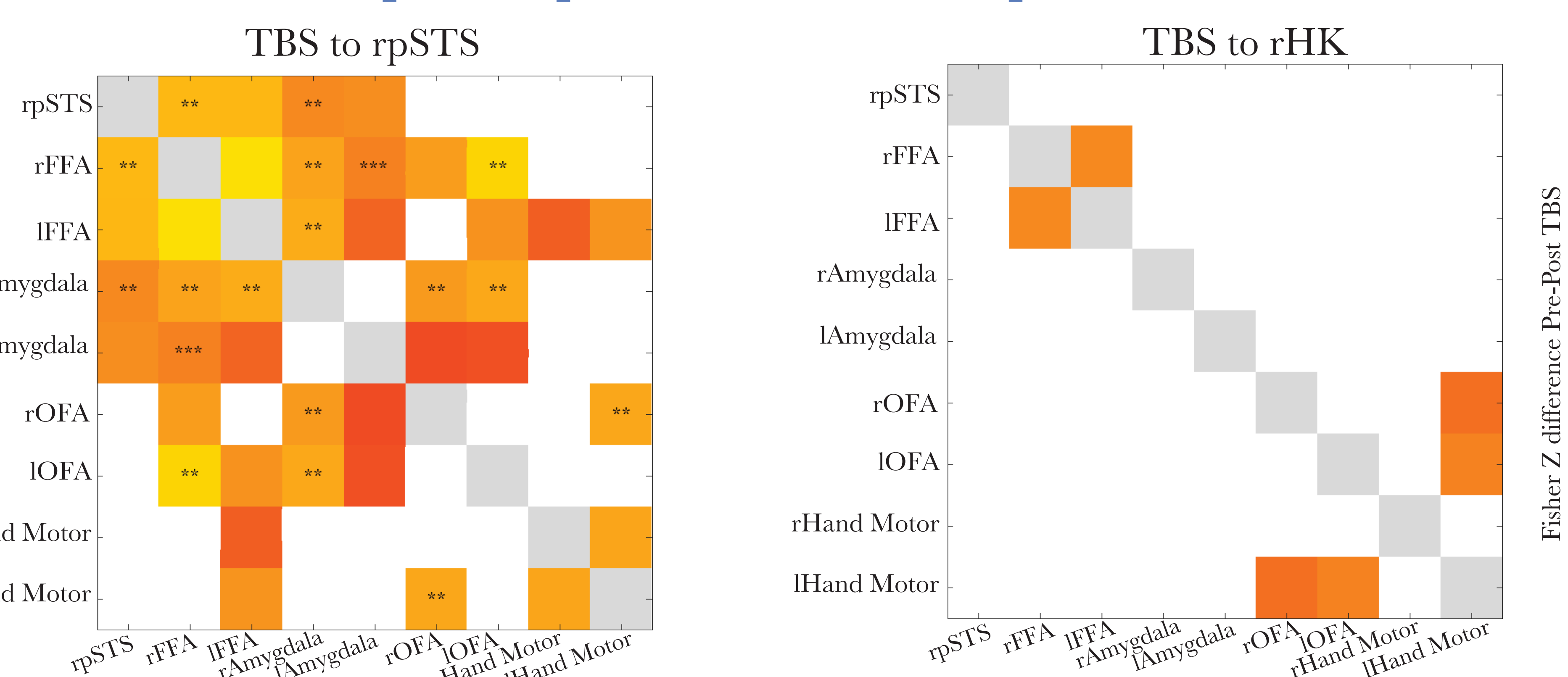
### Correlations pre and post TBS to the right hand motor cortex seed



Correlations between the rHK and other face selective regions do not decrease after rHK and sometimes decrease after rpSTS stimulation

The decreases, between rHK and face selective regions post TBS stimulation to the rpSTS are observed in fewer participants than for correlations to the rpSTS

### Correlations pre and post TBS between all pairs of ROIs

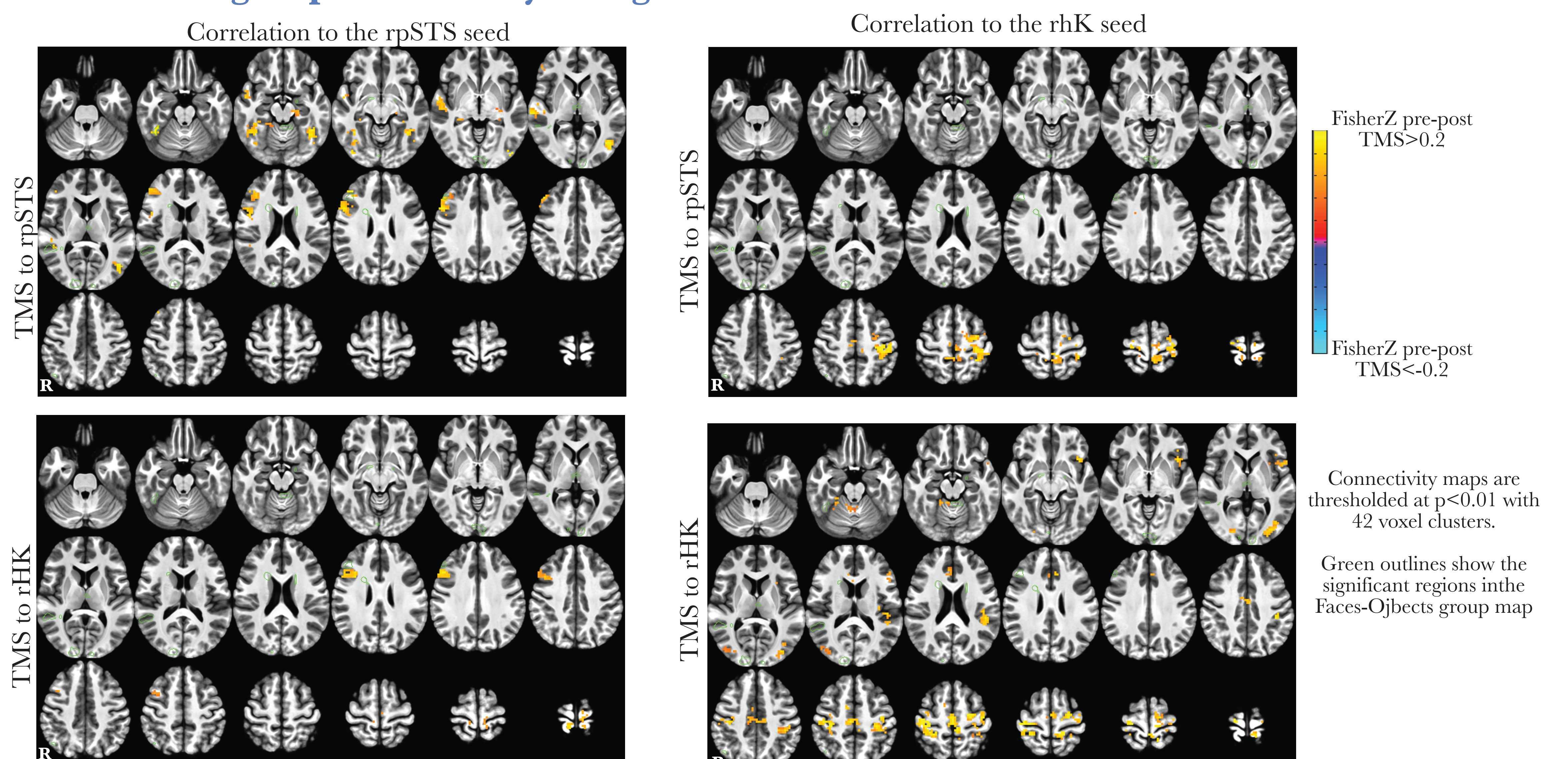


Values are only shown if the pre vs post TBS difference is significant ( $p < 0.05$ ) at the group level. \*\* is  $p < 0.01$  and \*\*\* is  $p < 0.001$ . The diagonal is grey since there ROI time series were not correlated to themselves

There are significant correlation decreases after TBS to the rpSTS in 16 of the 21 pairs of ROIs in the face selective network. These decreases occur even when neither of the ROIs directly received TBS stimulation

There are some correlation decreases after stimulation of the rHK, but these are of relatively lower magnitude and don't cross a  $p < 0.01$  threshold

### Whole brain group connectivity changes for correlations to the stimulation sites



An intentionally liberal threshold was used for these group maps to show that the correlation changes observed in the regions of interest are not part of a large whole-brain decrease in connectivity

## CONCLUSION

**Stimulation to the rpSTS decreases correlations between pre-defined face selective regions even between regions that didn't directly receive TBS**