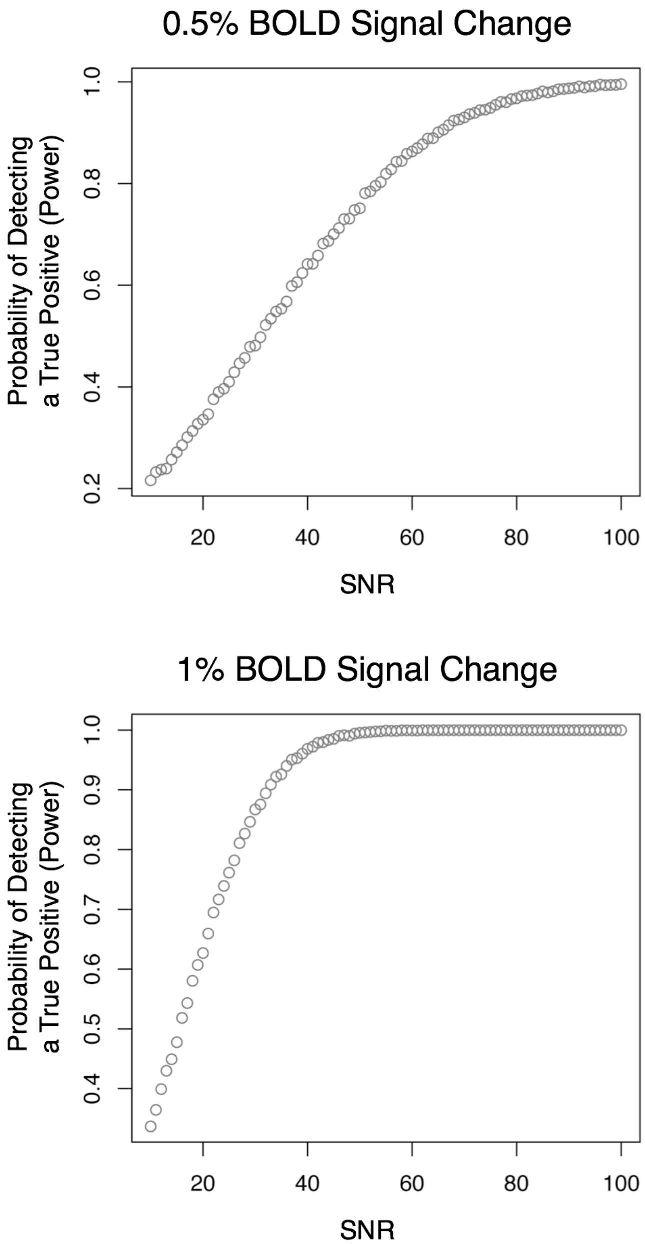
Supplementary Material

Signal to Noise Ratio

In the current study, signal-to-noise ratio (SNR; sometimes also referred to as tSNR) is defined as the ratio of the signal's mean to the standard deviation of the signal. Because the potential BOLD differences in fMRI are quite small (e.g., typically around .5% to 2% deviation from baseline), it is important to determine if it is likely that given the SNR in the study it is possible to detect such differences. The larger the SNR, the easier it is to detect the signal of interest. For the present study, we used a 3T scanner and chose larger voxel sizes, both of which increase SNR (Scouten et al., 2006; Takahashi et al., 2003). To evaluate the sensitivity of our experimental design, following Parrish et al (2000) we conducted a series of simulations that determined, given our experimental design, for various SNR values what is the probability of identifying a signal change of a magnitude of 0.5% and 1%. We then calculated the SNR in the study itself on a voxel-wise level to determine our ability to identify reliable effect sizes in various regions.

The simulation was conducted using R. We derived a synthetic model of the expected activity by convolving the boxcar design with a canonical HRF (mean = 1). To this, varying amounts of smoothed noise (modeled by an autoregressive moving average) were added to obtain different SNR ratios. This process was repeated for 10,000 iterations for each noise level, where each iteration assigned a different randomly generated noise value. We then determined the probability of finding a reliable correlation for that noise level by evaluating the "boxcar-predictor-plus-noise" data against the original boxcar predictor via regression (see Parrish et al., 2000 for details of method). This simulation method indicates the power to reliably detect a given MR percent signal change as a function of SNR. Our simulations determined that, given a power of .80, the minimum SNR to detect a MR signal change of 0.5% was 54, whereas the minimum SNR to detect a MR signal change of 1% was 27. Supplementary Figure 1 shows the results of both simulations.



Supplementary Figure 1. Results of SNR simulation. The plots represent the required minimum SNR value to detect a 0.5% and 1% signal change for a given power. Power, the probability of detecting a true positive, was determined by the simulation and is depicted on the vertical axis.

In addition, we wanted to determine whether individual participants contributed sufficient SNR values in the particular ROIs related to our hypotheses, and whether these SNR values differed as a function of hemisphere (LaBar et al., 2001). Thus, following the above formula for SNR, for each subject we created SNR maps on a voxel-wise basis by dividing the time-series mean by the time-series standard deviation.

References

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